Forest Stewardship Plan

Observatory Mesa

City of Flagstaff, AZ

211 West Aspen Avenue, Flagstaff, AZ 86001

June 30, 2015

Plan Prepared By

Arizona State Forestry Division, Flagstaff District Office

in cooperation with Flagstaff Fire Dept Wildland Fire Management Division

APPROVALS & SIGNATURES

Observatory Mesa Flagstaff Plan

Plan Start	April 5, 2015
Duration	10 years, or until situation requires a revision
Plan Expiry	April 5, 2025
Plan Acreage	2,309

Plan Preparer

I have, to the best of my knowledge, and as a qualified resource professional, prepared this plan in accordance with state and national standards, and consistent with the landowner's primary forest resource management objectives, as found in the following:

- City of Flagstaff city-wide Forest Stewardship Plan
- City of Flagstaff Wildland Urban Interface Code
- City of Flagstaff and Coconino County Regional Plan
- Greater Flagstaff Area Community Wildfire Protection Plan

In addition this plan is consistent with and meets the intention of:

- AZ State-wide 20 Year Strategy
- Flagstaff Watershed Protection Project
- Four Forest Restoration Initiative
- Firewise and Fire Adapted Communities Programs
- National Cohesive Strategy

Plan Prepared by:

Flagstaff District Office, Arizona State Forestry Division 3650 Lake Mary Rd, Flagstaff, AZ 86005

Authorized Preparer Signature — Date: 9-30-2015

Approved By: Andrew Owen, Forest Stewardship Coordinator, Arizona State Forestry

Authorized Signatory

I have reviewed the Forest Stewardship Plan for Observatory Mesa and agree, as feasible, to conduct management activities consistent with the plan during the period specified.

Reviewed/Endorsed by: Mark Brehl, Flagstaff Watershed Protection Project Operations Specialist, City of Flagstaff, AZ

Signature of Authorized Signatory — Date: 9-28-15

Accepted/Approved by: Paul Summerfelt, Wildland Fire Management Officer, Flagstaff Watershed Protection Project Manager, City of Flagstaff, AZ

Signature of Authorized Signatory — Date: 28 Sept 15

USDA

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DOCUMENT OVERVIEW

The purpose of this document is to provide management guidelines for the Observatory Mesa area in Flagstaff, AZ that is under ownership of the City of Flagstaff. Contents of this document address the thirteen resource elements required for a management plan to be considered a Stewardship Plan under the guidelines of the US Forest Service Forest Stewardship Program. The thirteen resource elements are:

1. Soil and Water
2. Biological Diversity
3. Aesthetic Quality
4. Recreation
5. Timber
6. Fish and Wildlife
7. Threatened and Endangered Species
8. Forest Health
9. Archeological, Cultural, and Historic Sites
10. Wetlands
11. Fire
12. Carbon Cycle
13. Range/Agroforestry/Silvopasture

The Forest Stewardship Program, in Arizona, is a tool to provide forest management support and technical assistance to landowners in targeted priority and critical areas. This stewardship plan is specific to the Observatory Mesa project area but takes into account recommendations and critical areas at the larger landscape level. Recommendations are based upon field observations, field inventory, and acquired knowledge by natural resource managers employed by the Arizona State Forestry Division and augmented by like inputs from professional natural resource managers from the City of Flagstaff, AZ. There may be a variety of options to achieve the goals stated within this document. The guidelines should not be confused with the actual treatment implementation which will be overseen and or conducted by the City of Flagstaff Wildland Fire Management Division as part of the Flagstaff Watershed Protection Project (FWPP).

PRIMARY GOALS & OBJECTIVES

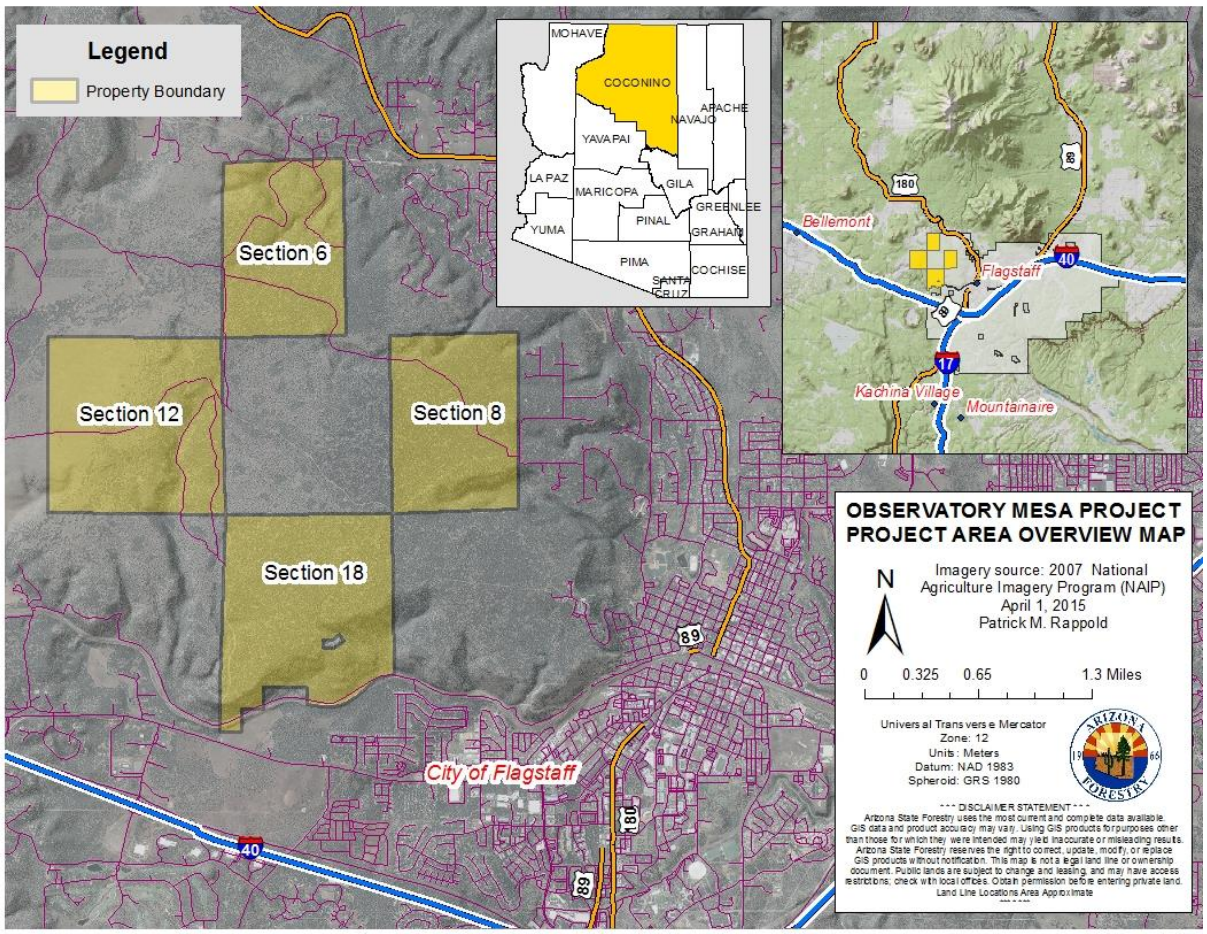
The purpose of the proposed action is to improve the health and sustainability of forested conditions within the Observatory Mesa area by moving vegetative conditions in the project boundaries towards desired conditions specified in the Forest Stewardship Management plan. Active management on Observatory Mesa is necessary to restore the area to a more healthy forest condition by:

- Reintroducing fire as a natural part of the ecosystem,
- Reducing fuel buildup to help reduce the intensity and spread of unwanted wildland fire,
- Reducing overall stand densities and moving stand conditions toward a forest structure more representative of pre-settlement fire regimes,
- Maintain and enhance the diversity of vegetative age classes, vegetative species, and vegetative structure,
- Reducing mistletoe infection levels to endemic levels where possible,
- Mimicking natural disturbance processes while maintaining habitat,
- Providing a mosaic of habitat conditions through time including open forest and savannah conditions, and
- Maintaining the aesthetic qualities, recreational opportunities, watershed values, wildlife habitat, native plant diversity, and other features of the area.

Property History

On February 14, 1912 Arizona was granted Statehood in the United States and several million acres of land were designated as State Trust Lands. These lands were managed by the Arizona State Land Department to provide revenues generated from sale of harvested timber to the schools in trust of the State of Arizona. The city of Flagstaff made steps beginning over a decade ago to purchase this land though various funding mechanisms, and were successful in 2013 in acquiring the land though voter approved bonds and reclassified the land to be maintained for conservation values. In September, the city was awarded $6 million from the Arizona State Parks Board under the Growing Smarter State Trust Land Acquisition Fund.

PROPERTY



Map 1. Project Area Overview Map

Address
Flagstaff, Arizona
Coconino County

Property Description
The project area is located within northwest portion of the City of Flagstaff, with one Section outside but immediately adjacent to the city corporate boundary. Parcel numbers for the project area are 102-15-002 and 102-15-001. The property boundaries are delineated by fence lines over much of one area. Condition of the fence varies throughout the area. In addition there are US Forest Service boundary markers posted on the adjacent Federal Land.

Legal Description[1]
Tract: 2 Section: 6 Township: 21N Range: 07E Tract: 3 Section: 6 Township: 21N Range: 07E Tract: 4 Section: 6 Township: 21N Range: 07E Tract: 5 Section: 6 Township: 21N Range: 07E Tract: 6 Section: 6 Township: 21N Range: 07E Tract: 7 Section: 6 Township: 21N Range: 07E Sixteenth: SW Quarter: NE Section: 6 Township: 21N Range: 07E Sixteenth: SE Quarter: NW Section: 6 Township: 21N Range: 07E Sixteenth: NE Quarter: SW Section: 6 Township: 21N Range: 07E Sixteenth: SE Quarter: SW Section: 6 Township: 21N Range: 07E Sixteenth: NW Quarter: SE Section: 6 Township: 21N Range: 07E Sixteenth: SW Quarter: SE Section: 6 Township: 21N Range: 07E GOVT LOTS 2-7, SW NE, SENW, E2 SW, W2 SE Quarter: NW Section: 8 Township: 21N Range: 07E Quarter: SW Section: 8 Township: 21N Range: 07E Sixteenth: NW Quarter: NE Section: 8 Township: 21N Range: 07E Sixteenth: SW Quarter: NE Section: 8 Township: 21N Range: 07E Sixteenth: NW Quarter: SE Section: 8 Township: 21N Range: 07E Sixteenth: SW Quarter: NE Section: 8 Township: 21N Range: 07E W2, W2 E2 Tract: 1 Section: 18 Township: 21N Range: 07E Tract: 2 Section: 18 Township: 21N Range: 07E Tract: 3 Section: 18 Township: 21N Range: 07E Tract: 4 Section: 18 Township: 21N Range: 07E Quarter: NE Section: 18 Township: 21N Range: 07E Sixteenth: NE Quarter: NW Section: 18 Township: 21N Range: 07E Sixteenth: SE Quarter: NW Section: 18 Township: 21N Range: 07E Sixteenth: NE Quarter: SW Section: 18 Township: 21N Range: 07E Sixteenth: SE Quarter: SW Section: 18 Township: 21N Range: 07E Quarter: SE Section: 18 Township: 21N Range: 07E GOVERNMENT LOTS 1-4, NE, E2 W2, PT SE NLY OF SLY LINE OF BNSF RR 1 EXC 3052197 Tract: 5 Section: 19 Township: 21N Range: 07E Sixteenth: NW Quarter: NW Section: 19 Township: 21N Range: 07E Sixteenth: NE Quarter: NE Section: 19 Township: 21N Range:

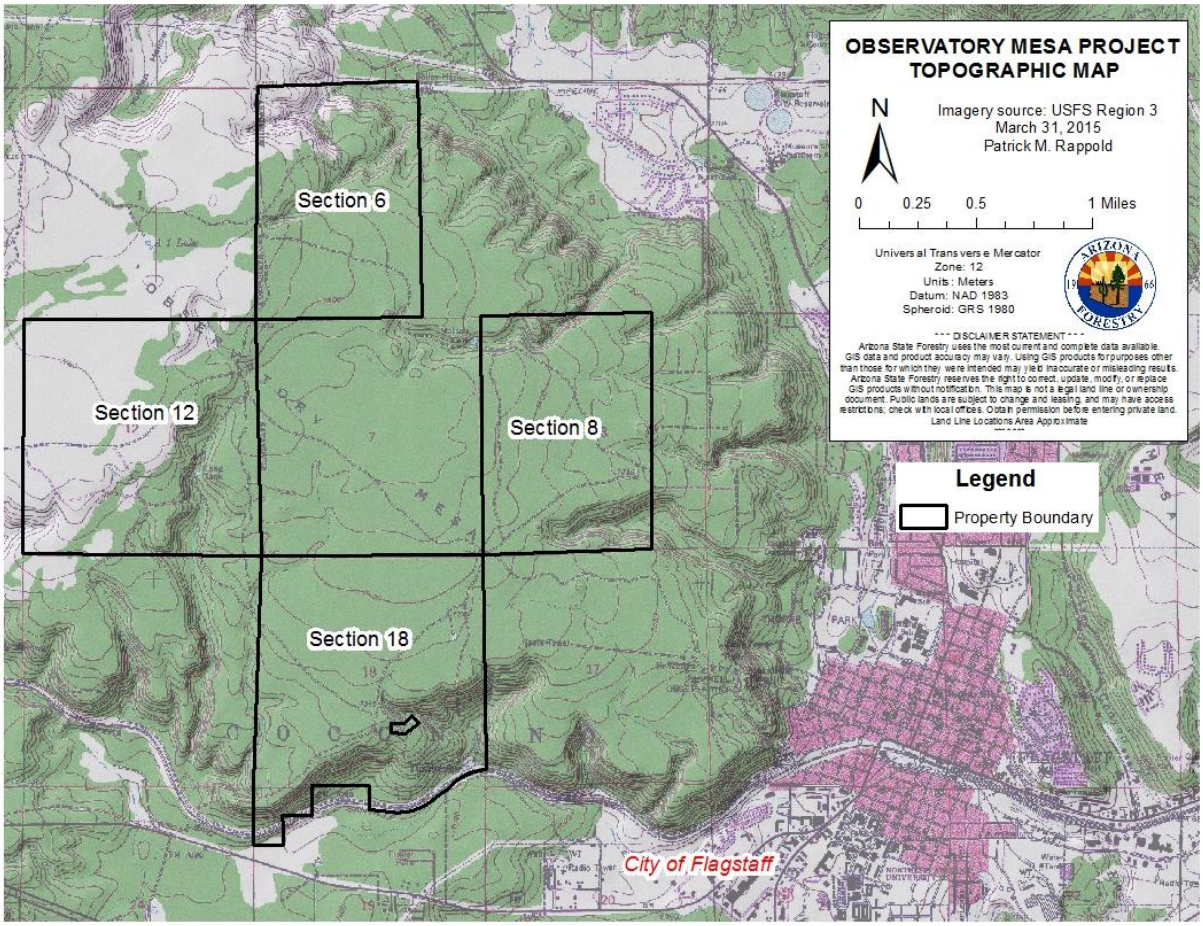
[1] Legal description from Coconino County Assessor's Office. Accessed online March 3, 2015

07E Sixteenth: NW Quarter: NE Section: 19 Township: 21N Range: 07E GOVERNMENT LOT 5, NE NW NW, PT N2 N2 NE N OF SLY LINE BNSF RR. Section: 12 Township: 21N Range: 06E ALL

Mapped Acres (GIS)	2,309
Surveyed Acres	2,309
Forested Acres	1,700
Perennial Stream Length (ft)	27,342
Boundary Marked	Partial

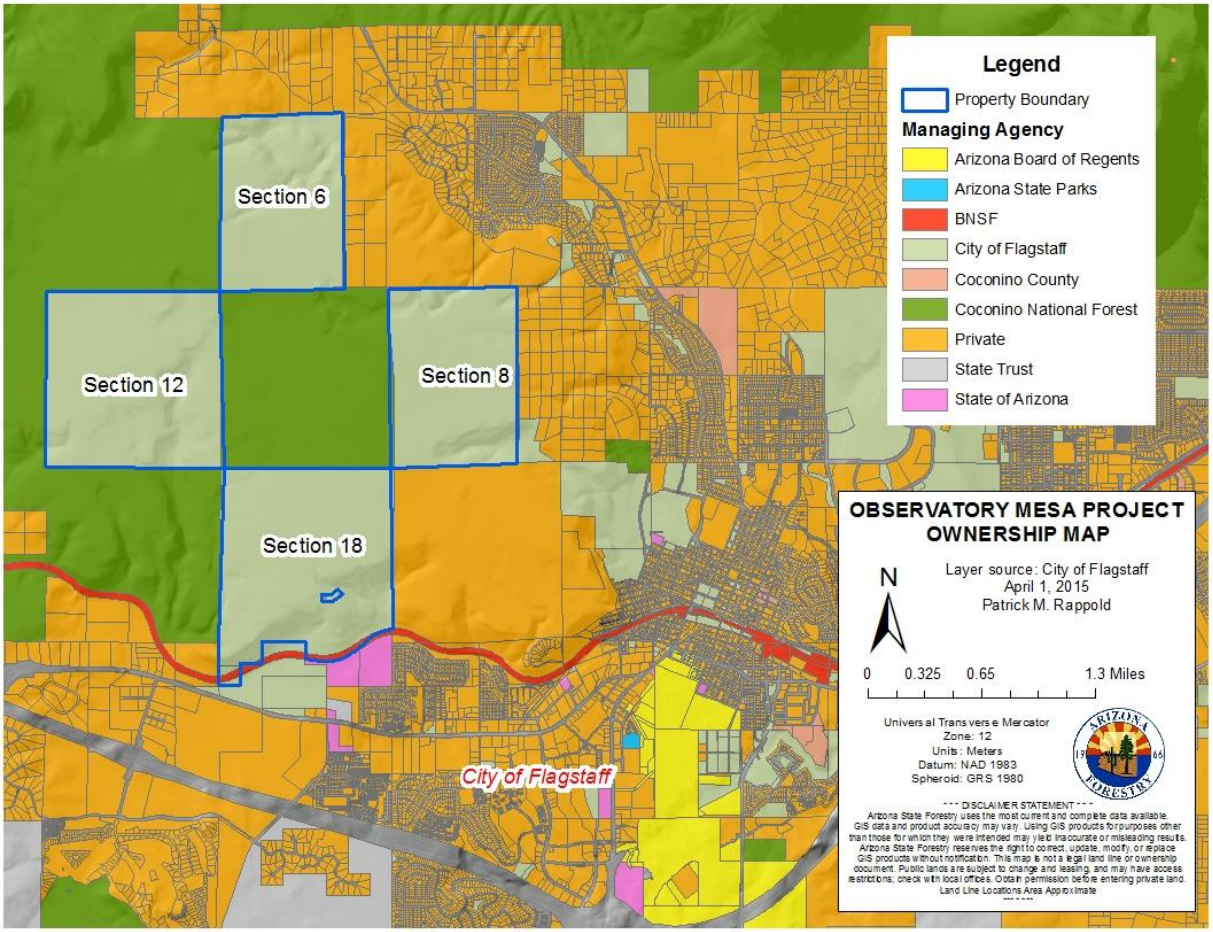
Property Maps

Topographic Map



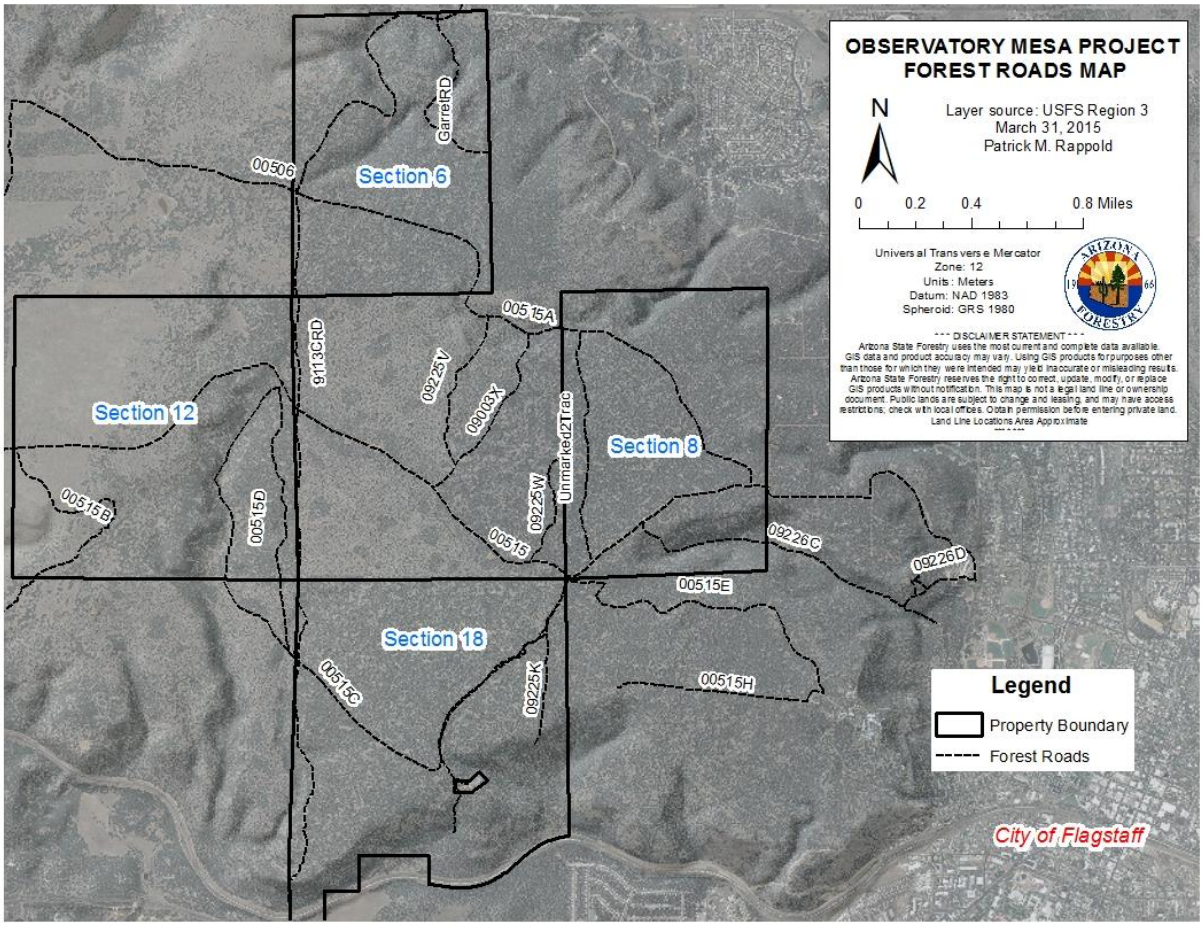
Map 2. Topographic map with hillshading

Ownership Map



Map 3. Ownership map

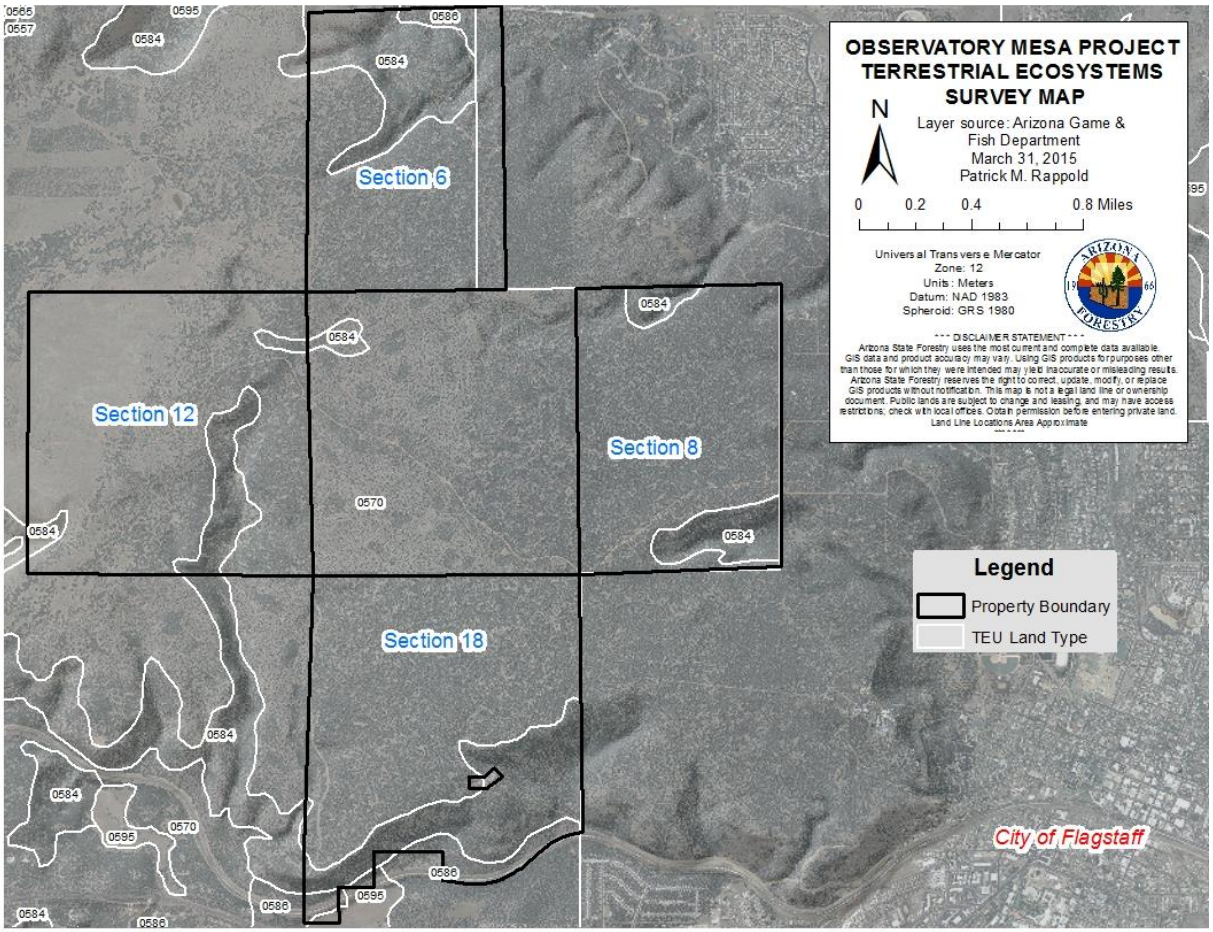
Forest Roads Map



Map 4. Forest Roads Map –Note: Not all roads illustrated are open to public use.

Property Resource Conditions

Soil & Water



Map 5. Terrestrial Ecosystems Survey Map. GIS Layer Source: Arizona Game & Fish Department

In the Observatory Mesa Project Area, Terrestrial Ecosystems Survey (TES) data is available for predictions and limitations of soil and vegetation behavior for selected land uses. Map 5 shows the TES data for the project area. The primary TES mapping units on this project are 570 and 584.

Mapping unit 570, Mollic eutroborralfs and Lithic eutroborralfs soils, are the majority of the soil type within the project area and exhibits the following attributes: soils are moderately deep to shallow, very stony/cobbley, loam, 0-15% slope. The climate class is low-sun-cold (LSC) 5-0, edaphic, complex. Soil temperature class is frigid. Climatic vegetation class is ponderosa pine (PIPO) with a minor component of gambel oak (QUGA). Understory grasses common to this soil type are Arizona fescue (FEAR2), pine dropseed (BLTR), mountain muhly (MUMO), and Kentucky bluegrass (POPR). Surface component cover at climax is 45% rock

fragments, 5% bare soils,75% litter, and 10% vegetation. The potential canopy cover at climax condition is approximate 65%, current condition is 50%. The potential for this soil type is moderate to high for natural regeneration, with moderate for timber production and forage production. Limitations include low potential for mechanical re-vegetation, with severe limitations for un-surfaced roads, and off road vehicles (harvesting equipment). Erosion hazard is slight and windthrow potential is moderate.

Mapping unit 584, Mollic eutroborralfs and Typic argiborrals soils exhibit the following attributes: soils are, moderately deep to deep, very stony/cobbley to extremely cobbley, loam, 15%-40% slope. The climate class is LSC 5-0, edaphic, complex. Soil temperature class is frigid. Climatic vegetation class is PIPO with a minor component of QUGA. Understory grasses are BLTR, FEAR2, muttongrass (POFE), littleseed muhly (MUMI), MUMO, Carex spp., squirreltail (SIHY), and POPR. Surface component cover at climax is 45% rock fragments, 5% bare soils, 75% litter, and 10% vegetation. Current conditions tend to be a bit lower in the litter and vegetation percentages and higher in bare ground than climax. The potential canopy cover at climax condition is approximately 65%, current condition is 45%. The potential for this soil type is moderate to high for natural regeneration, with moderate for timber production and forage production. Limitations include low potential for mechanical re-vegetation, with severe limitations for un-surfaced roads, and off road vehicles (harvesting equipment). Erosion hazard is slight and windthrow potential is moderate.

Given these conditions, all operations should be planned during periods of dry/frozen weather or under sufficient snow cover to protect soils. Temporary roads should be kept to a minimum. Planting and site preparation may be conducted depending on site specific conditions.

From a natural resource manager's standpoint the description of the soil characteristics equates to the majority of the soils in the project being very clay like. This fact becomes very apparent on the forest roads after extended periods of precipitation. Therefore it is recommended to plan active stand management with mechanized equipment during times of low or minimal precipitation. Prolonged distribution of the forest soils during periods of high precipitation may lead to extensive damage of forest roads and possible contamination of soil run-off into the stream systems.

There are several significant first order ephemeral streams/drainages which flow to the north and west into the Rio de Flag, and to the south into Clay wash which flow directly into the Rio de Flag. Mechanical operations should either be avoided or limited in these major drainages. In the smaller minor drainages, a filter strip and/or deferral should be considered

or necessary to protect the stream course from damage during operations. In addition, these could serve as a high density wildlife travel way/corridor.

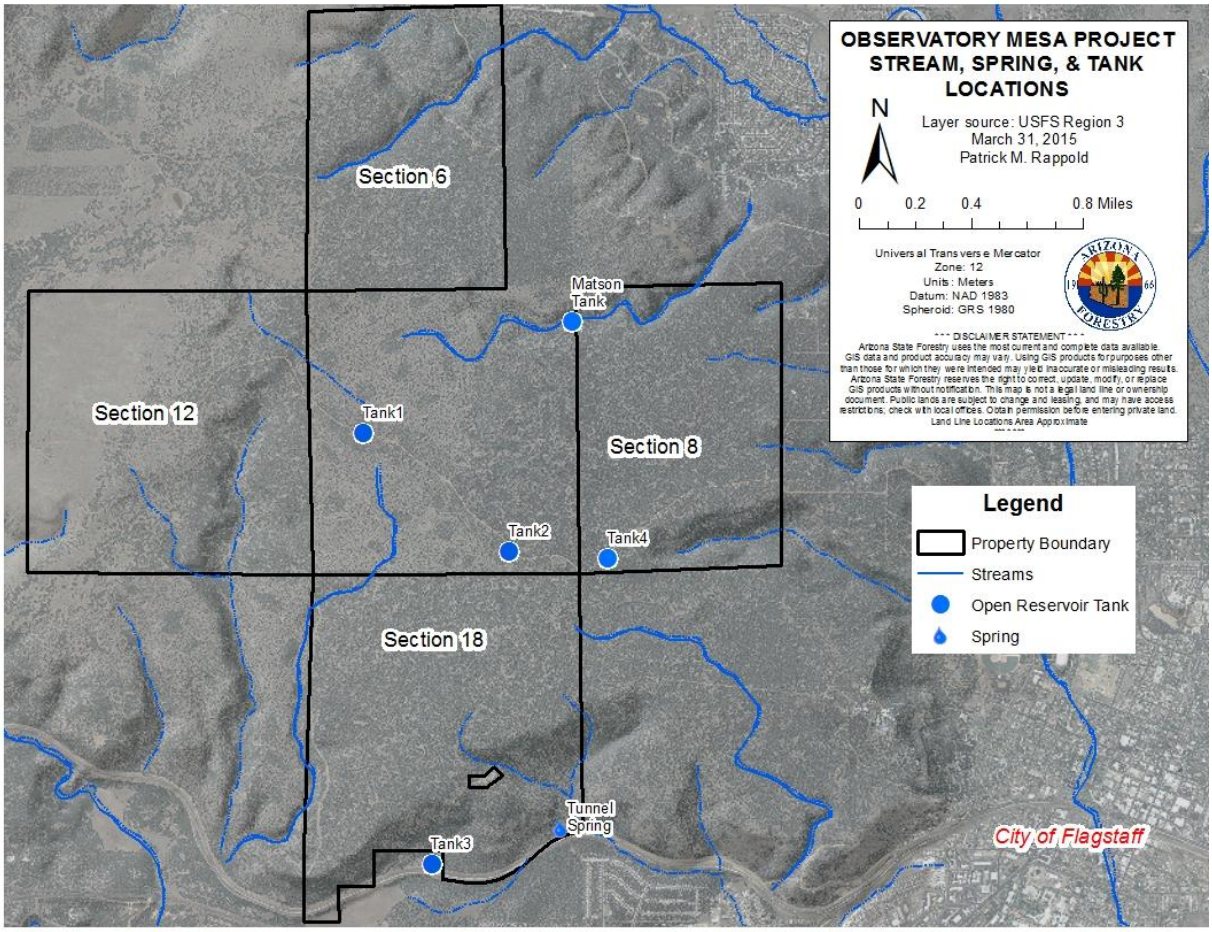
The project area is within the Rio De Flag sixth code watershed. The Arizona Department of Environmental Quality (ADEQ), under authority of the Clean Water Act, has designated beneficial or protected uses for these streams. The protected uses are Full Body Contact, Incidental Human Contact, Cold Water Fisheries, Agriculture irrigation, Livestock and Wildlife watering.

There are no riparian areas on the project. Riparian areas have unique soil and vegetative characteristics such as hydric soils and associated obligate plant species. None of the ephemeral drainages on the project exhibit these.

Tunnel Springs is located with the project boundary (Map 6). Belle Spring is located adjacent to the project boundary, just south of Section 12. These sites, though not riparian areas, are important to the ecosystems and should be managed appropriately. Actively managing the area for fuels hazard reduction will also assist in preserving the quality of the water resources, in the project area. These springs and seeps are generally located along the periphery of the Observatory Mesa escarpment, and occasionally along rock outcrops in the drainages.

There are no Jurisdictional Wetlands on the project area. These have very strict guidelines and are rarely met within the ponderosa pine zone. These include hydrophidic soils, periods of inundation, and obligate vegetation populations. Similarly, navigable stream have strict designations as to the ability to support commerce a certain point and duration in time.

Activities occurring in the watershed and first order stream courses are covered by the “silvicultural and headwater exemptions” of the Clean Water Act and the Section 401 and 404 permitting requirements.



Map 6. Stream, open reservoir tank, and spring location map. GIS Layer Source: Arizona State Land Department

Biological Diversity

Diverse, healthy and productive ecosystems are essential for the agricultural, forest, and natural environments on which humans depend. Biodiversity is the variety of organisms (life) found within a specified geographic region and the processes that support those organisms. Maintaining or increasing diversity can increase ecosystem resilience to environmental stress and increase forest health.

The biodiversity within the project area is typical of a northern Arizona ponderosa pine forest, though this property is near the middle transition range for the ponderosa pine vegetation zone. Figure 1 illustrates the different life zones across Arizona and their relation to elevation. Elevation of the project area extends from 7,500 feet above sea level to 7,300 feet. Overstory is comprised almost entirely of ponderosa pine. A small number of douglas fir trees were identified during the field inventory process. The understory shrubs are comprised of; Arizona rose (*Rose arizonaica*). Common grasses include; Arizona Fescue

(*Festuca Arizonica*), Mountain muhly (*Muhlenbergia montana*), western wheat grass (*Agropyron smithii*) blue gramma (*Bouteloua gracilis*), and bottle brush squaretail (*Elymus elymodies*). There were observations of Silver lupine (*Lupinus argintinous*) and Rocky Mountain iris (Iris missouriensis Nutt.).

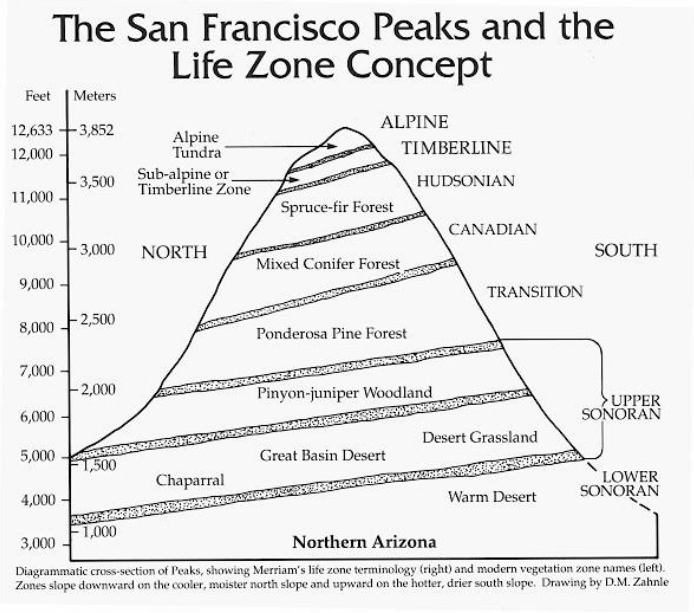


Figure 1. Elevation transition zones for northern Arizona. Adapted from D.M. Zahnle

At the mid-scale level, there are sparse areas within the project area where it is expected that piñon-juniper and aspen woodlands could exist. Most likely wildland fire and grazing by domesticated and non-domesticated large ungulates, has had an impact on the regeneration and forest stand type. From a landscape level analysis the project area is predominately a ponderosa pine forest.

It is important to select management options that offer the greatest opportunities for promoting wildlife habitats and conserving biodiversity while at the same time fulfilling multi-resource goals and objectives for the project.

Aesthetic Quality

Like many other parts of northern Arizona, the Observatory Mesa project area has a very high aesthetically quality. Opportunities to capture stunning views of the San Francisco Peaks are possible throughout most of the project area (Figure 2). The lack of developed structures across the landscape creates a feeling of solitude and remoteness, despite being very close to Interstate 40 and the city of Flagstaff. Closure of most of the forest roads lessens the

occurrence of seeing or hearing motorized vehicles. This enhances the quality of the experience that many people seek when exploring and recreating in forested areas.

Recommendations for maintaining a high aesthetic quality of the project area and implementing ecosystem improvement projects include:

1. Decreasing the occurrence of straight lines. Transition zones between areas of high tree density and low density should be gradual.
2. Burn slash piles as soon as possible. When economically feasible complete removal of slash from the site should be considered.
3. Following initial treatment and where possible, limit casual and open access on forest roads across the property. Limiting the number of vehicles will also help to keep the cost of road maintenance to a minimum.

Figure 2. View of the San Francisco Peaks from FS Road 506 leading into Section 12 of the Observatory Mesa project area

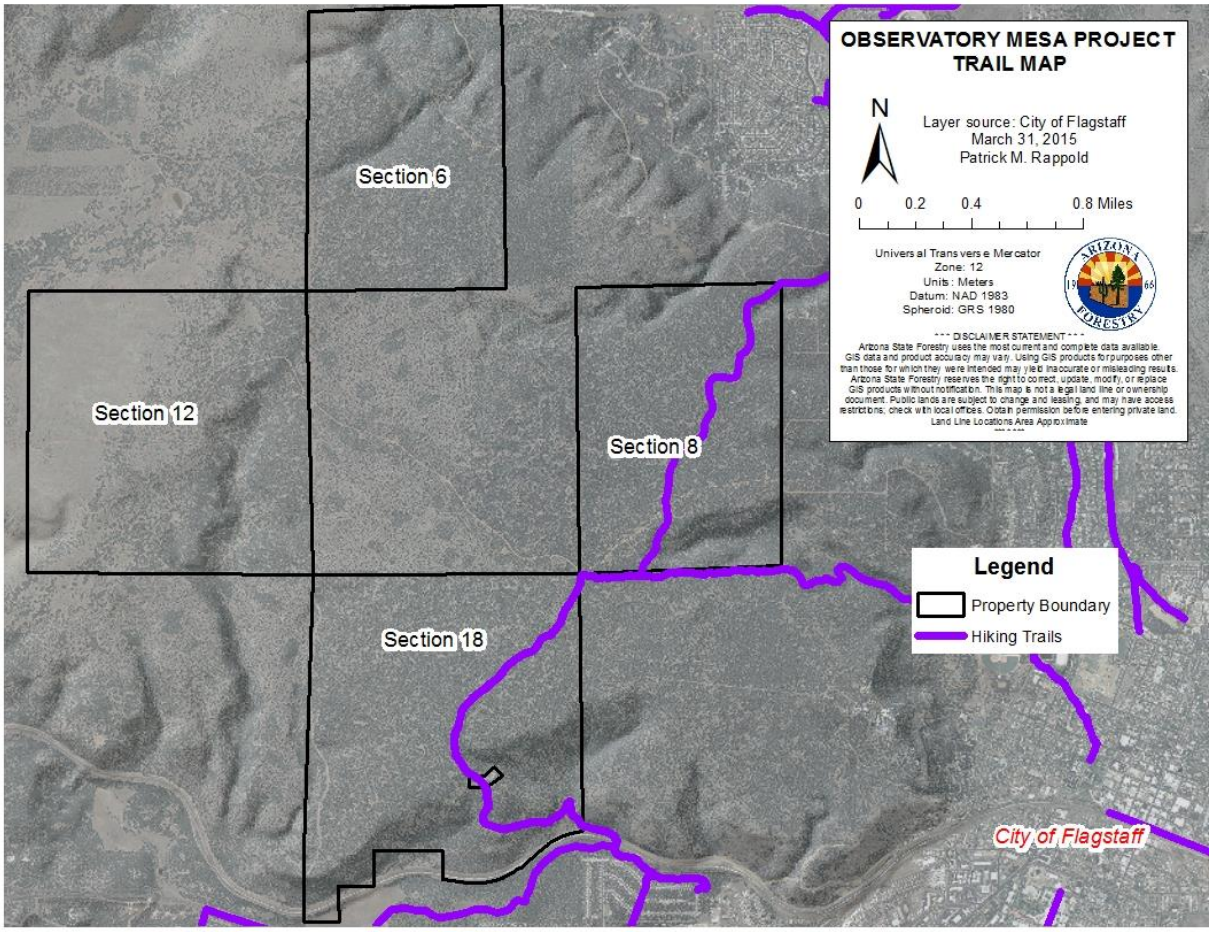
Wildlife species such as deer, elk, pronghorn, antelope, fox, black bear, mountain lion, squirrels and birds can add to the scenic beauty experience for most visitors. During seasonal migration larger numbers of foraging wildlife such as deer and elk, may be seen in the area as they move from winter to summer ranges.

Due to the amount of public recreation and use, aesthetic values are one of the more heavily weighted concerns during treatment and management decisions for this project. Visual changes due to thinning treatments, burning, equipment use and site prep are expected. Management decisions such as buffers near trails and/or timing of project work should be considered if practical and possible to reduce impacts. Prior treatments and studies show that ponderosa pine and mixed conifer trees transition to a released condition as a result of thinning treatments. Overall, site response would be expected to add tree diameter growth

and increase understory production, which in turn would enhance aesthetic qualities of the area.

Recreation

Of the four Sections in the Observatory Mesa Project area, Section 8 receives the most recreational activity. The Flagstaff Loop Trail and the Flagstaff Urban Trail System (FUTS) both cross through Section 8. Cross country skiing and snowshoeing are common winter recreational activities in the Section. Hiking, trail running, and dog walking occur in Section 8 year round.



Map 7. Recreational Trail System Map. GIS Layer Source: City of Flagstaff and ESRI Database

Field observations have brought to light that there is periodic conflict between adjacent year round homeowners and forest recreationalists, even among recreationists themselves, in Section 8. Comments from year round homeowners at Observatory Mesa Stakeholders Meetings have confirmed these observations. Of particular concern is degradation of the ditch system on the east side of Westridge Road directly across from the access gate for FS Road 515. Limited parking space in front of the access gate often forces recreationalists to

park in the ditch, on the opposite side of the road. Adjacent year round homeowners are concerned that consistent parking in the ditch will degrade the ability of the ditch to divert flowing water from the road surface. This concern has led the homeowners to inform recreationists that they are parking on private property, typically a note under the windshield wiper of the recreationalist's vehicle. Crudely written notes nailed into trees have conveyed the message that cross country skiers do not appreciate hikers walking in their ski tracks.

Possible actions to improve relations between recreationists and adjacent year round homeowners include:

1. Increasing the amount of available parking, and
2. Provide parking information on signage near Thorpe Park

Further study to quantify both the number of individuals that use Section 8 for recreational purposes, on a daily and weekly basis, as well as the type use they enjoy may be warranted.

The relative flat topography of Section 8 does not entice the large masses of "snow play" recreationists that gravitate towards areas along Snowbowl Road and State Highway 180. If the City of Flagstaff did want to capitalize on the "snow play" visitors, the topography of the southern area of Section 18 would lend itself to downhill snow sledding, but extensive signage, road work, and parking area improvement would be required.

In Section 18 of the Observatory Project, a number of unmarked single track trails were found. Most likely these trails were created by individuals engaged in mountain bicycling. Some of the trails that were identified traversed now cut or downed barbed wire fence lines that had been utilized when the grazing of cattle was actively being done in the Observatory Mesa area.

To better serve the citizens and visitors to the City of Flagstaff, a handicap accessible trail could be considered, as part of the recreation experience on Observatory Mesa. Consideration of a handicap accessible footpath takes into account the changing demographics of the United States and the City of Flagstaff motto "Service at a Higher Elevation". This service should be all encompassing and consider the mobility limitations of all the citizens and visitors of Flagstaff.

While not inexpensive the planning and development of a handicap accessible trail on the Observatory Mesa can most likely be leveraged with Federal grants, offered by the US Forest Service or Arizona State Forestry. The Community Challenge Grant Program offered by

Arizona State Forestry is an example of one avenue to expanding access to forest recreation opportunities.

The project area is within the Arizona Game and Fish Department's 11M Game Management Unit. Rifle hunting is not allowed anywhere in the 11M Unit and the discharge of firearms is also not allowed within the City of Flagstaff corporate limits. Sections 6, 8, and 18 are within the Flagstaff corporate limits. Section 12 is outside of the corporate limits. In Section 12 the use of shotguns for hunting of small game is permitted. Big game archery-only hunting is allowed in all four sections of the Observatory Mesa project area. Hunting of any kind is not permitted within ¼ mile of an occupied residence or building within Flagstaff corporate limits. Camping is not permitted with the City of Flagstaff Corporate boundaries. This includes Section 6, 8, 18, and Section 12.

Timber

The U.S. Forest Service administered timber sales for the Arizona State Land Department prior to 1966. Numerous harvesting activities have occurred since the early 1900's across these sections.

- In Section 6, Sawtimber harvests have occurred in 1919, 1925, 1950, and 1972 with pulpwood sales in 1964, and 1975.

- In section 12, sawtimber harvests occurred in 1919, 1925, 1951, 1973, and pulpwood sales occurred in 1964, and 1974. The Bell fire severely impacted the western portion of this section.

- On Section 8 Sawtimber harvest occurred in 1919, 1925, 1972, and a pulpwood sales in 1964 and 1975.

- On 18, sawtimber harvests occurred in 1919, 1925, 1955, 1973, and a pulpwood sale in 1964 and 1974.

- On Section 19, sawtimber harvests occurred in 1955, 1956 (Right-of-way project), 1963 (Right-of-way project), and a Right-of-way project pulpwood sale in 1963.

Most harvests centered on the larger sawtimber classes earlier in the century and the pulpwood and intermediate sawtimber classes later. Little data exists which describe the exact treatments from those time periods.

Currently, across the landscape, the value of the standing timber is marginal. Most of the timber is characterized as small diameter and will not yield high grade (shop and clear

grades) lumber when processed, based upon lumber grading specifications of the Western Wood Products Association[2]. The anticipated yield of lumber from the standing timber on the Observatory Mesa project will be of a quality in line with factory grade and lower lumber grades. Yield studies of ponderosa pine logs with small end inside bark diameter from 5 – 12 inches have yielded mostly #3 Common grade lumber[3]. Using published composite lumber prices, the #3 Common grade lumber would have a value of $300 per thousand board feet[4]. Prices for ponderosa pine logs in the Pacific Northwest and Inland Empire are $350 per thousand board feet for logs with diameters on the small end between 6-11 inches. Logs with small end diameters in excess of 12 inches the published log value at a sawmill is $380 per thousand board feet[5]. As of February 2015, the average price of delivered ponderosa pine logs to a sawmill, in Arizona, ranges from $200 per thousand board feet to $300 per thousand board feet. Most sawmill owners in Arizona are processing logs into pallet cants that will be exported to the Country of Mexico. The range of prices paid for pallet cants is between $300 per thousand board feet to $400 per thousand board feet. Implementation of strict phytosanitation regulations on imported solid sawn wood products by the Country of Mexico has for the short term increased the value of pallet cants being exported south of the border. As more sawmill enterprises begin heat treating their shipment, the price is expected to drop.

Despite the low quality of timber in the project area, it is still desired to be good stewards of the forest and utilize the material to its full potential. It is also desired that the cost of implementing stand improvement projects be decreased (offset) by the value of the product removed. The potential for some of the treatment costs being reduced are dependent upon market conditions and the schedule and operating capacity of logging contractors.

At current time, consistent with forest treatments throughout the area over the past decade, harvesting and associated debris disposal activities can be expected to $400-$800 per acre.

[2] Western Wood Products Association. 2011. Western Lumber Grading Rules. Portland, OR

[3] Lowell, E.C. and D.W. Green. 2001. Lumber Recovery from Small-Diameter Ponderosa Pine From Flagstaff, Arizona. *In*: Vance, Regina K.; Edminster, Carleton B.; Covington, W. Wallace; Blake, Julie A. comps. 2001. Ponderosa pine ecosystems restoration and conservation: steps toward stewardship; 2000 April 25-27; Flagstaff, AZ. Proceedings RMRS-P-22. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

[4] Based upon Random Lengths Composite Lumber prices for Ponderosa Pine (Inland) #2&Btr 1x12 R/L. Accessed online February 27, 2015. http://www.randomlengths.com/Woodwire/RL-Lbr-Pnl/

[5] Inland Forest Management, Inc. Log Prices in North Idaho and the Inland Northwest. Accessed online February 27, 2015. http://inlandforest.com/log-prices/

Fish and Wildlife

Figure 3. Adult mule deer that has been consistently observed as part of larger herd in Section 6 of the project area

The presence of nearby neighborhoods and recreationists have resulted in interaction between wildlife and humans in the project area. Field observations of mule deer herds have identified one established herd that is most commonly sighted in Section 6 and Section 8. Elk and antelope are also known to visit the area although sightings did not occur during the forest inventory collection process of this project.

A number of open reservoir dirt tanks are located within and adjacent to the project boundaries. Location of these tanks is identified in Map 6. Water within these tanks is a primary source of water for wildlife. Other troughs and water drinkers are adjacent to the project boundaries. Management of the Observatory Mesa area should preserve these tanks.

Consultation with wildlife biologists from the US Fish and Wildlife Service and the Arizona Game and Fish Department was done to gain professional recommendations and suggestions on desired conditions. A summary of the recommendations are presented in the table below.

Arizona Game and Fish Department Review

The Arizona Game and Fish Department (AZGFD), Arizona Environmental Online Review Tool, is a preliminary environmental screening tool used to gain an initial scope of fish and wildlife resources and Special Status Species that may be within the project boundaries or vicinity. This initial report listed several Species of Concern which may occur within a five mile radius of the project location. Within this list are northern goshawk, American peregrine falcon, Navajo Mexican vole, multiple bat species and winter populations of bald eagles. The Mexican spotted owl (MSO) is also included on this list with a federal designation of- Listed Threatened.

Correspondence with Hannah Griscom, Urban Wildlife Planner with the AZGFD, suggested established wildlife guidelines within the *Northern Arizona University Ecological Restoration Institute, Wildlife Habitat Values and Forest Structure in Southwestern Ponderosa Pine: Implications for Restoration, Working Paper No. 26* (2013), be referenced regarding general desired conditions for wildlife across the project area. Site visits, analysis and consultation have also produced additional site/project specific recommendations and have been outlined below.

Geographical information provided by the Arizona Game and Fish Department does show that part of the project area has been identified as a northern goshawk post-fledging family area. The post-fledging area or PFA is an area used by young goshawks until they are no longer dependent upon adult goshawks for food. A PFA is typically close to a goshawk nest and functions to provide cover for young goshawks from predators. Recommendations for maintain adequate stand conditions in a PFA include[6]:

1. Keep the canopy cover greater than 50 percent, and
2. Maintain a well-developed understory that includes snags

Reynolds et al.[6] state that the removal of trees in the understory and generating small openings in the forest will help produce and maintain adequate habitat for the northern goshawk. Prescribed fires are also identified by Reynolds et al. as a forest management activity that benefits and boosts goshawk habitat.

[6] Reynolds, Richard T.; Graham, Russell T.; Reiser, M. Hildegard; and others. 1992. Management recommendations for the northern goshawk in the southwestern United States. Gen. Tech. Rep. RM-217, Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 90 p.

Threatened and Endangered Species

US Fish and Wildlife Review

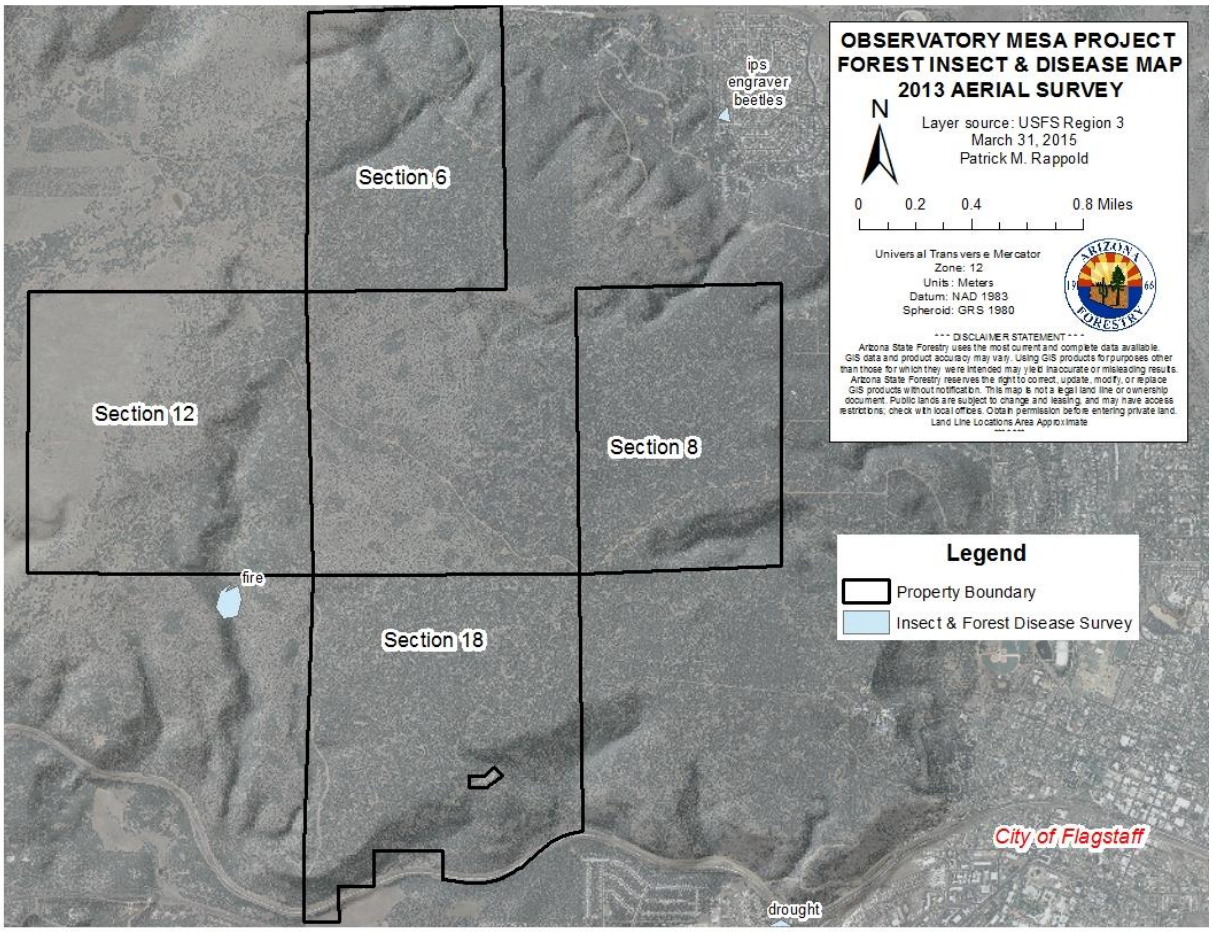
The Mexican Spotted Owl (MSO) is currently a federally listed species; Listed Threatened. The U.S. Fish and Wildlife Service (USFWS) has regulatory authority over all federally listed species under the Endangered Species Act. Due to the federal status of this species and several other Species of Concern within the list, Shaula Hedwall, Senior Fish and Wildlife Biologist with the USFWS was consulted in March 2015. As a result of this consultation the USFWS can currently support the overall goals of this forest stewardship plan, for wildlife and forest health thinning. Comments and recommendations are summarized below.

- No known MSO Protected Activity Centers (PACS) are within a half-mile of the project boundaries. Due to the distance and topography, there are no avoidance measures needed for the implementation of thinning or prescribed burning projects.
- A northern goshawk Post-Fledgling Area (PFA) lies within the project boundary. The northern goshawk is protected under the Migratory Bird Treaty Act and is currently listed as a "species of concern". Efforts should be made to avoid impacts to breeding birds, maintain or enhance large tree density and canopy cover at nest sites. Breeding season or other seasonal times for project activity avoidance, which may need to be taken into consideration. Harvesting and hauling within occupied Post-Fledgling Areas (PFAs) should not occur during the breeding season; March 1 to September 30.
- The bald eagle is no longer listed under the Endangered Species Act (ESA) as Endangered (removed in 2007), but is protected under the Bald and Golden Eagle Protection Act (BGA). Wintering populations of eagles may occur seasonally within the vicinity of the project/property, but should not be adversely impact by the proposed actions.

Forest Health

This property is in overall fair/good health however, there are indicators spanning across the property suggesting some forest health issues including; pitch tube on single trees (indicative of bark beetle activity), orange "flagging" of needles on lower branches, branches with little or no new growth, moderate size trees standing dead or recently fallen, and dwarf mistletoe in areas. One consideration is to monitor the regeneration and allow for select trees to grow with adequate space to avoid a homogenous forest. This can occur when the majority of the trees removed are in the smaller size classes retaining the larger diameter older trees, all in

the same age class. The goal is to achieve and maintain densities in most size classes of trees, increase species diversity, while maintaining reduced risk to loss by fire. Aerial detection survey flights conducted by US Forest Service in 2013 did not identify any areas of concerns (Map 8). However, in the surrounding forests small patches of damaged areas caused by the western pine beetle (*Dendroctonus brevicomis*) and the ips engraver beetle (*Ips* spp.) were identified in the 2013 aerial survey. Reducing stand densities will assist the forested area in becoming more resistant and resilient to attack by insects and diseases.



Map 8. Forest Insect and Disease Activity Detected During 2013 US Forest Service Aerial Surveys. GIS Layer Source: US Forest Service Region III

Invasive/Non-Native Species

Invasive non-native species can be plants, animals, and other organisms which may have been introduced (either intentionally or by accident), into areas outside their natural range. These non-native species can cause alterations to ecological functions and compete with, or prey upon, native species. They may also cause environmental, social impacts and economic impacts such as a reduction of available forage for wildlife and livestock, increased wildfire

risk, and increased soil erosion. The term noxious weeds or invasive plants are often used interchangeably.

Within their natural range, most species are kept in check by natural agents that restrain their establishment and spread. However, once moved to a new region, species may be released from these normal biological and physical constraints, resulting in uncontrolled spread. When this happens, native species may be displaced and ecosystems may be disrupted.

Identification of the initial source of invasive non-native plant species can often be difficult. Both historical and current activities such as grazing, vegetation treatments, recreation use, road maintenance, travel along roadways and trails, and/or off-road use may affect the abundance and distribution of invasive non-native plants within a given area. Ground disturbing activities which remove or damage existing native vegetation, and where mineral soil is exposed, increase the potential for the establishment and spread of these plant species. A severe wildland fire event may result in the complete loss of tree canopy, understory vegetation and ground cover, creating bare soil conditions. Increased light, along with changes to soil structure and nutrient cycling, could result in an increased growth and spread of invasive non-native plants.

Invasive non-native plant species are common throughout the Flagstaff area, as they are in most southwestern ponderosa pine forests. Several of the most common species are Dalmatian toadflax (*Linaria dalmatica (L.) Mill.*), common or wooly mullein (*Verbascum thapsus L.*), knapweed (*Centaurea L.*), and Russian thistle (*Salsola L.*), leafy spurge (Euphorbia esula L.), and Scotch thistle (*Onopordum acanthium* L.)[7].

Specific surveys for invasive non-native plants were not completed as a part of the initial field inventory process, due to project timing and seasonal winter weather conditions (plants dormant and several inches of snow covering the ground). However, as part of project implementation and stewardship program monitoring, if invasive non-native plants are located within the project area, best management practices should be implemented where practical to minimize the transport and spread of plants and/or their seeds. Recommendations may include, but are not limited to, avoidance of areas with established plants communities and/or equipment and vehicle wash stations to prevent transport and spread. Means of mechanical (hand pulling, digging and disposal off-site) or chemical control

[7] Arizona Wildlands Invasive Plant Working Group. August 2005. Invasive Non-Native Plants That Threaten Wildlands in Arizona. Accessed online March6, 2015 http://www.swvma.org/InvasiveNon-NativePlantsThatThreatenWildlandsInArizona.pdf

(herbicide treatment) may be effective in reducing, controlling or eliminating the spread of non-native species. Utilizing cooperative integrated weed management will help ensure treatment success, as many invasive non-native plants cannot be controlled with one single method.

Dalmation toadflax (*Linaria dalmatica* (L.) Mill.)

Russian thistle (*Salsola tragus* L.)

Diffuse knapweed (*Centaurea diffusa* Lam.)

Woolly mullein (*Verbascum thapsus* L.)

Figure 4. Photographs of common nonnative invasive USDA NRCS National Plant Data Team. Available: http://plants.usda.gov/java/ [2015, March 6]

Continuous monitoring of the property and surrounding areas is critical to early detection and management recommendations. Additional information and treatment recommendations regarding invasive non-native species can be found at:

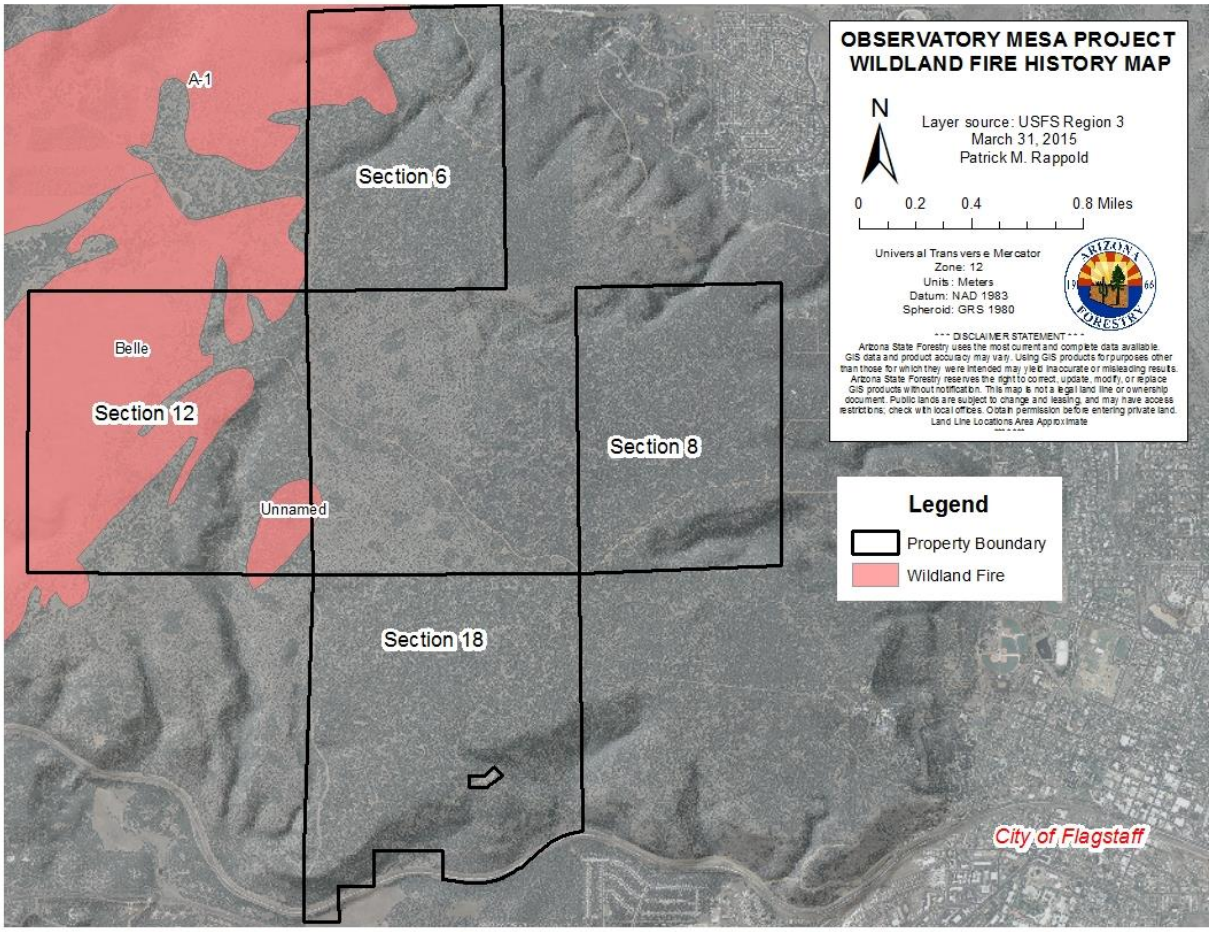
- Natural Resource Conservation Service, Plant Database: http://plants.usda.gov

- Invasive Plant's in Arizona's Forests and Woodlands. University of Arizona Cooperative Extension, Collage of Agriculture and Life Sciences. July 2007. Publication # AZ1436. On-line at: http://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1436.pdf

- Invasive Species, Weed Field Guides. United States Department of Agriculture, Southwestern Region, Forest Health: http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies

Fire

Map 9 illustrates that the project area has had natural fire across some of the landscape. The area of where the Belle Fire burned the landscape, in 1951, is now an open savannah like area. Across other parts of the project area, natural fire has not occurred for many years. Fire is a major component in the ponderosa pine forest with typical fire return under natural conditions occurring on a routine and repeated basis, typically at least every one to two decades. The vast majority of the project area is identified as Condition Class 3, which equates to a condition "*where several fire cycles have been missed and the condition of fuels is furthest from natural condition*". Many factors contribute to changing fire classes away from natural conditions. For example, low canopy base heights (low branches) and more density and connectivity in the canopy. Also, the duff and litter layers are significantly higher than in a natural state. For the forest type, of the project area, fire is a very natural part of ecosystem functions, but due to various reasons fire has not been allowed to burn across this area for many years. This property and much of the surrounding area has been under a full suppression management strategy for decades, successfully extinguishing all fires on or near the property. As a result, tree densities have increased and surface fuels accumulated adding to the potential risk for stand replacing fires, and moving this forest into a less natural state. It would be very beneficial to reintroduce fire to the ecosystem on a regular episodic basis to reduce the volume of down woody debris, and raise the crown base height. This management strategy is not without risk, but is preferably to unnatural severe fire with damaging post-fire impacts. Throughout the entire property there are high volumes of down woody debris that will add to the intensity of any fire seen on the landscape.



Map 9. Historical Fire Map. GIS Layer Source: US Forest Service Region III

Carbon Cycle

According to recent studies the majority of the carbon storage is in the over-story Ponderosa Pine. Continued management and improved forest health should increase the productivity of the carbon-cycle. There may be short term loss through management activities; however, this loss will most likely be small scale and overall long term effects will provide more beneficial in ecosystem restoration. Adversely, if the forest is in poor health the net carbon might be negative net value if there is a loss to the forest overstory component due to poor forest health or destructive fire. If the forest is lost to a destructive fire it will take hundreds of years to recover and become a productive carbon storage location again. Additionally, if there are prescribed burn objectives and recommendations this through time should result in a net increase in carbon storage studies suggest.[8]

[8] Hart, S.C., P.C. Selmants, S.I. Boyle, and S.T. Overby 2006. Carbon and Nitrogen Cycling in Southwestern Ponderosa Pine Forests. Forest Science 52(6): 683-693

Predicted models suggest the desert southwest will continue in persistent drought conditions, also suggesting climate will become hotter and dryer. This may have multiple and lasting impacts on individual trees and landscapes concerns. Some researchers are concerned with the possibility of forest stand conversion as the climate patterns change the vegetation may adapt and change as well. Most likely this would occur throughout time and begin in areas that are southwest facing slopes as these areas tend to already be hotter and dryer.

Range

Traditionally the Observatory Mesa project area had been utilized for grazing of sheep and cattle, when the main property owner was the Arizona State Land Department. As the ownership is now with the City of Flagstaff, domestic livestock grazing will be restricted as fences are installed or repaired.

Historic, Archeological, and Cultural Resources

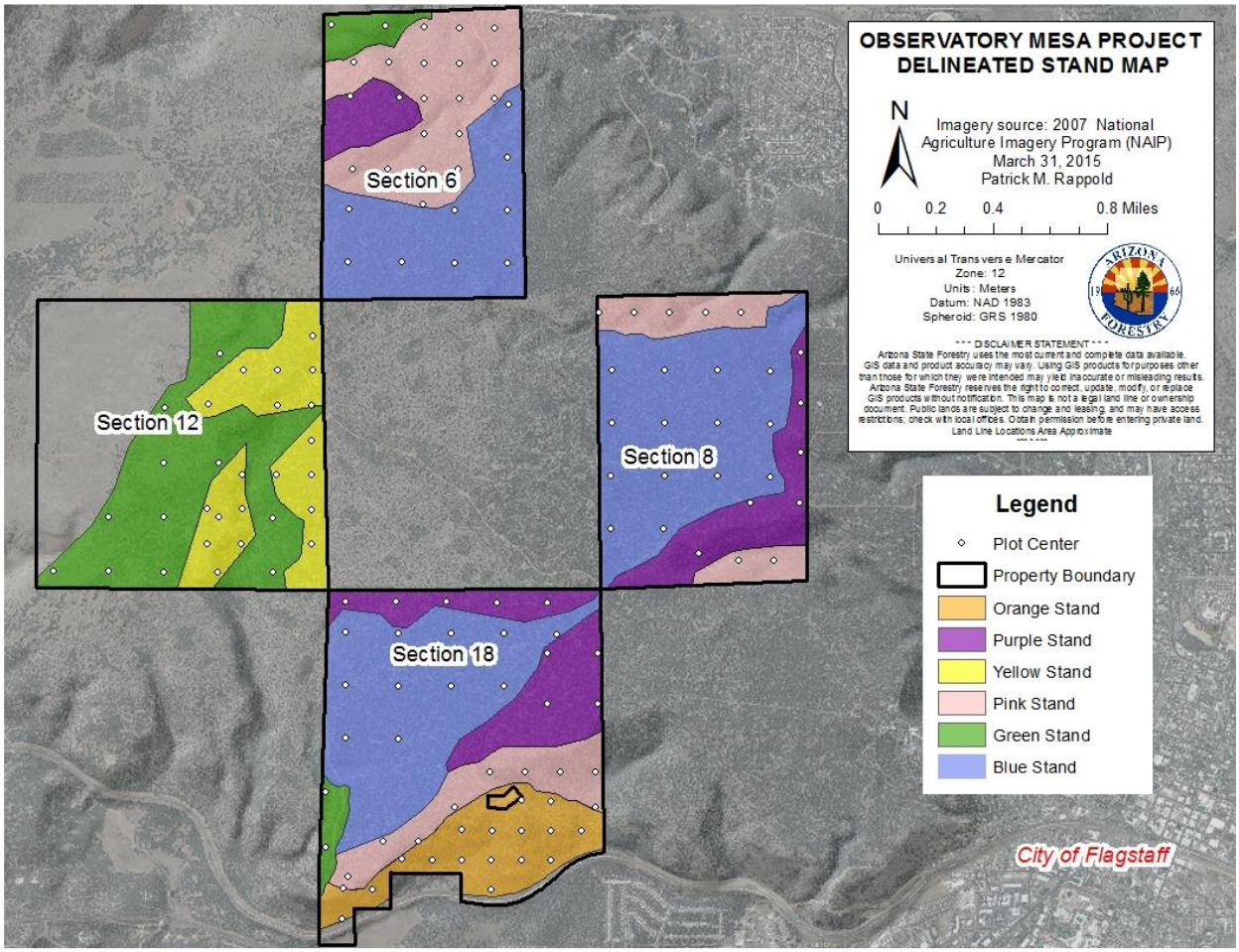
There are no known significant archaeological or sensitive cultural sites. If sensitive sites are found before or during treatment implementation, it is recommended that special care will be taken by identifying the area and restricting entry. Throughout the property there were a number of waist high stumps signifying potentially pre-settlement evidence (Figure 5). In the early 1900 cross cut saws were used where loggers cut the tree at waist high length leaving evidence of past management techniques and paths. To the extent possible these historical tree stumps could be preserved as benchmarks for historical stand densities.

Figure 5. A high barber chair stump in the Observatory Mesa project area. This is a good indicator of pre-settlement stand density levels

STAND DESCRIPTIONS AND MANAGEMENT

Inventory Procedure

In January 2015, Arizona State Forestry crews completed an inventory of forest resources on the project area. Inventory data was collected by means of variable radius plots at points throughout the four property sections. A 20 basal factor area prism was used to measure stand density at each of the plot locations. Location and number of plots were determined through delineating the forest sections by tree density using aerial imagery. Delineation patterns and plot locations for the purpose of forest inventory are presented in Map 10.



Map 10. Forest inventory stand delineation map

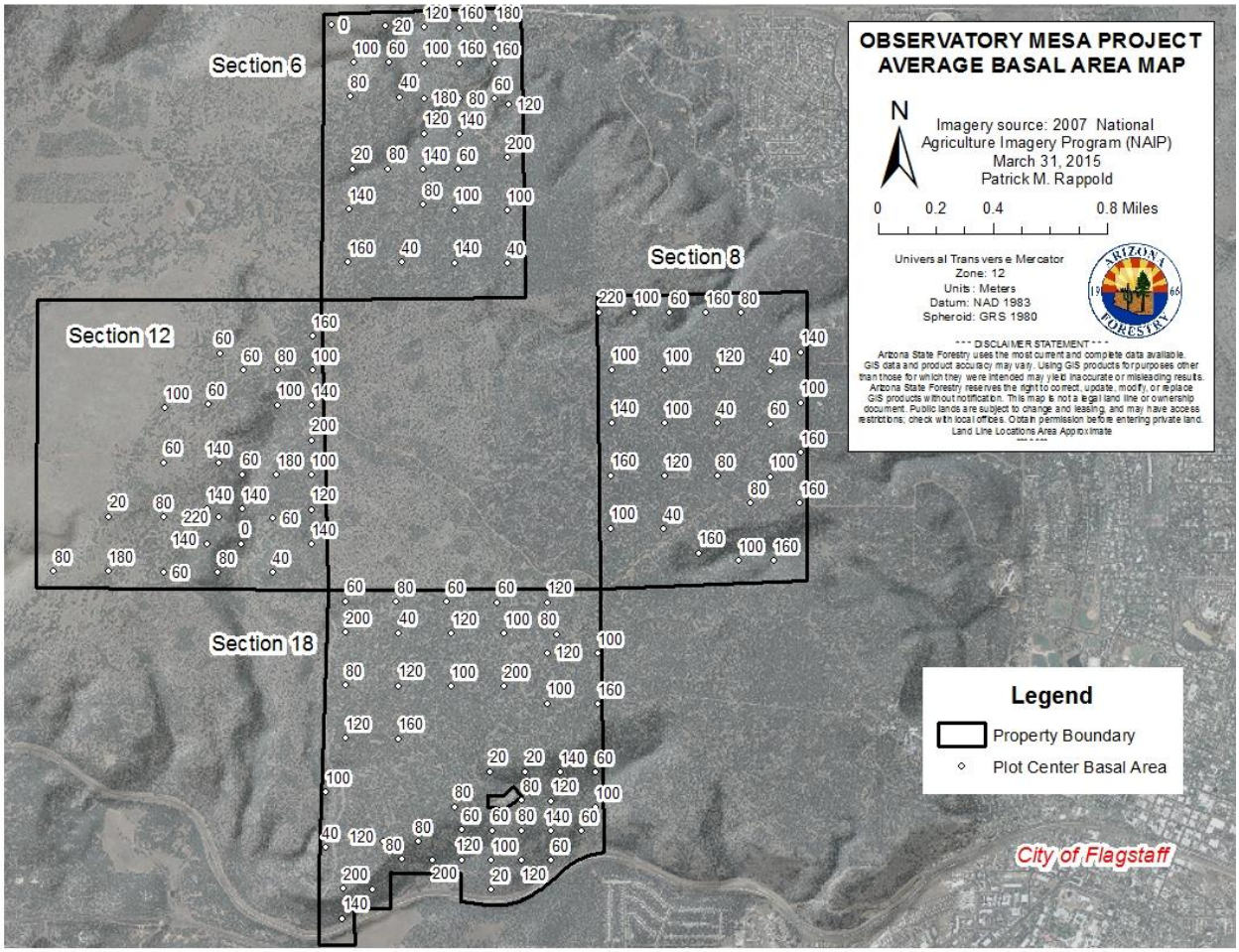
Table 1. Summarized Forest Inventory Data

Stand Identifier	*Number of Plots*	*Species Composition*[1]	*Average Tree Height (Ft)*	*Trees Per Acre*	*Average Basal Area*
Purple	17	PIPO	55	106	105
Yellow	19	PIPO	48	339	117
Pink	34	PIPO	52	155	106
Green	17	PIPO	45	90	69
Blue	34	PIPO	53	132	108
Orange	17	PIPO	54	124	105

[1] **PIPO = ponderosa pine**

The summarized inventory data is presented in Table 1. This information is presented for use as baseline data that the City of Flagstaff can archive and utilize as a component for monitoring future management activities. The original inventory data is available upon request and will be archived within the Arizona State Forestry Forest Stewardship Program.

For natural resource managers an important element of forest inventory data is basal area. Basal area translates to tree density, which typically in a southwest United States ponderosa pine forest has a direct correlation to risk of wildland fire, forest and tree health and climax growth indicators. Reduction of basal area is commonly a priority objective before industrial fiber supply or recreational purposes. Map 11 identifies the measured basal area for each of the variable radius plots.



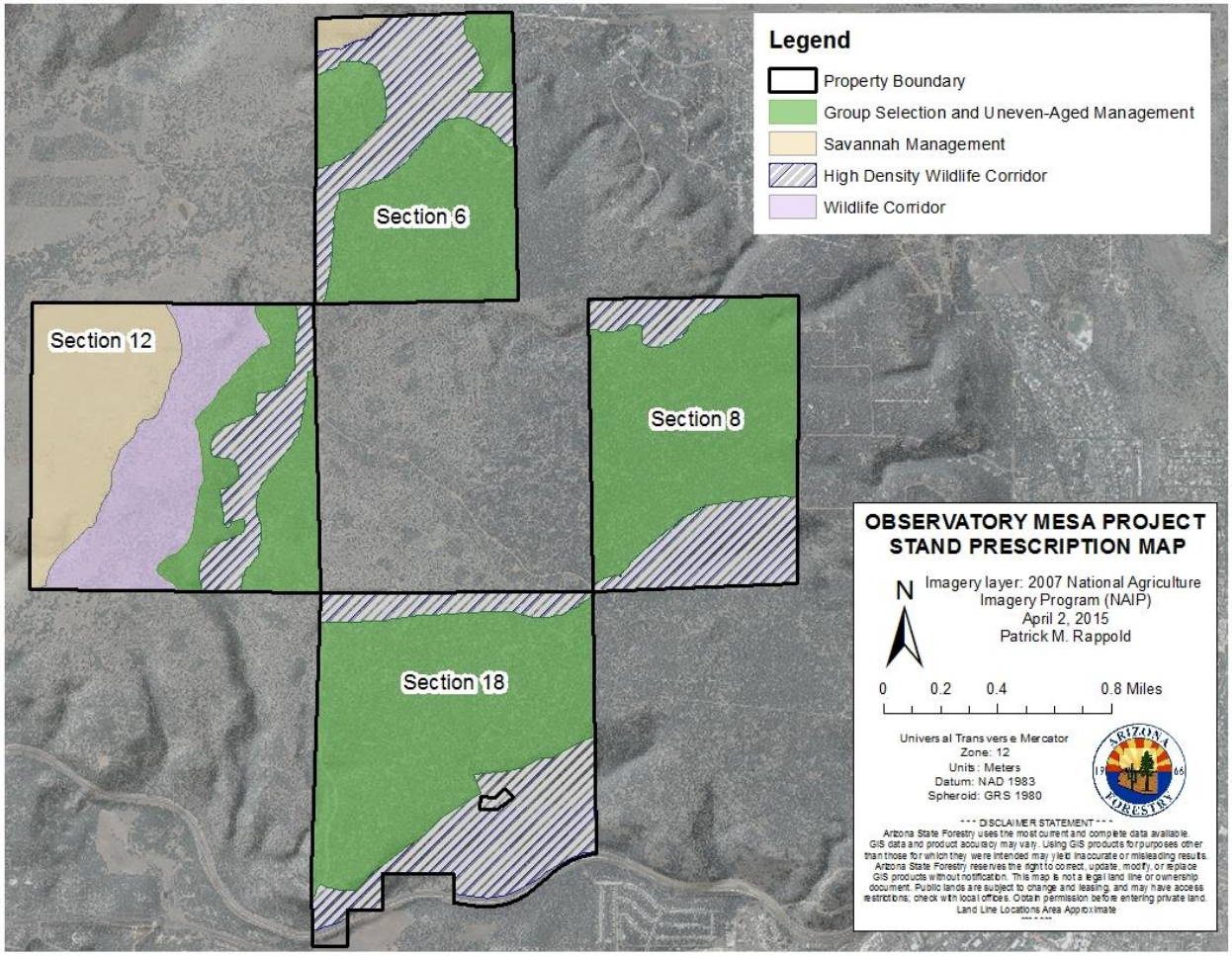
Map 11. Measured basal area information for the variable radius plots across the project area

Recommended Stand Prescriptions

It is understood that the City of Flagstaff will not be actively using the Observatory Mesa project area for industrial forestry purposes. The open-space designation, coupled with the close proximity and accessibility of the property to the citizens of Flagstaff, mandates that recreation and fuels mitigation considerations take priority. Because of this, stand delineation and management recommendations are broad and general. Across the Observatory Mesa landscape only four areas are delineated for management purposes. An overview of the stand management area delineation patterns is presented in Map 12. Current conditions and management recommendations for achieving desired conditions are presented in four different sections, for each of the four stand management areas.

Delineation of the stand management areas was done through analysis of the forest inventory data and the best available science on management of forests in the southwest United States.

Recommendations provided by the US Fish and Wildlife Service and the Arizona Game and Fish Department were also incorporated into the management suggestions.

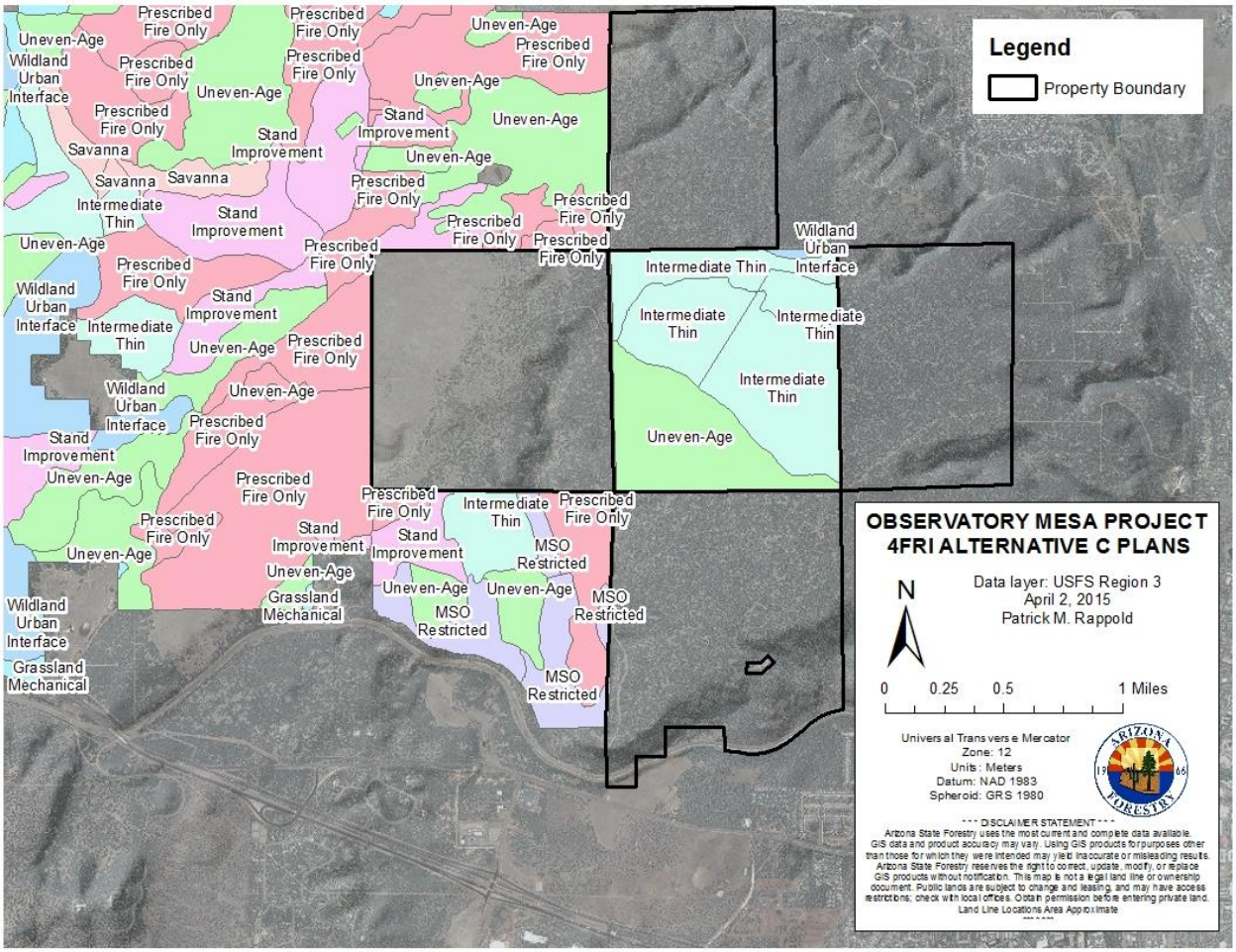


Map 12. Overview of stand delineation prescriptions

It would be remiss not to identify and take into consideration forest management plans adjacent to the Observatory Mesa project area. The most relevant of activities being the Four Forest Restoration Initiative (4FRI) that is being undertaken by the US Forest Service on adjacent Federal Lands. Map 13 illustrates the proposed treatment (Alternative C) areas of the 4FRI project that are bordering the Observatory Mesa project area. The 4FRI project is multi-year project that extends across 300,000 acres on four National Forests in Arizona. Depending upon numerous factors, the proposed 4FRI treatments identified in Map 13 may be changed slightly. The US Forest Service has several alternative treatment options and the Alternative C Proposal is presented in Map 13.

Actual on-the-ground management activities initiated by the City of Flagstaff may be influenced by the proposed management plans of the US Forest Service on adjacent lands. It is however

understood that the City of Flagstaff has different priorities and management objectives than the US Forest Service.

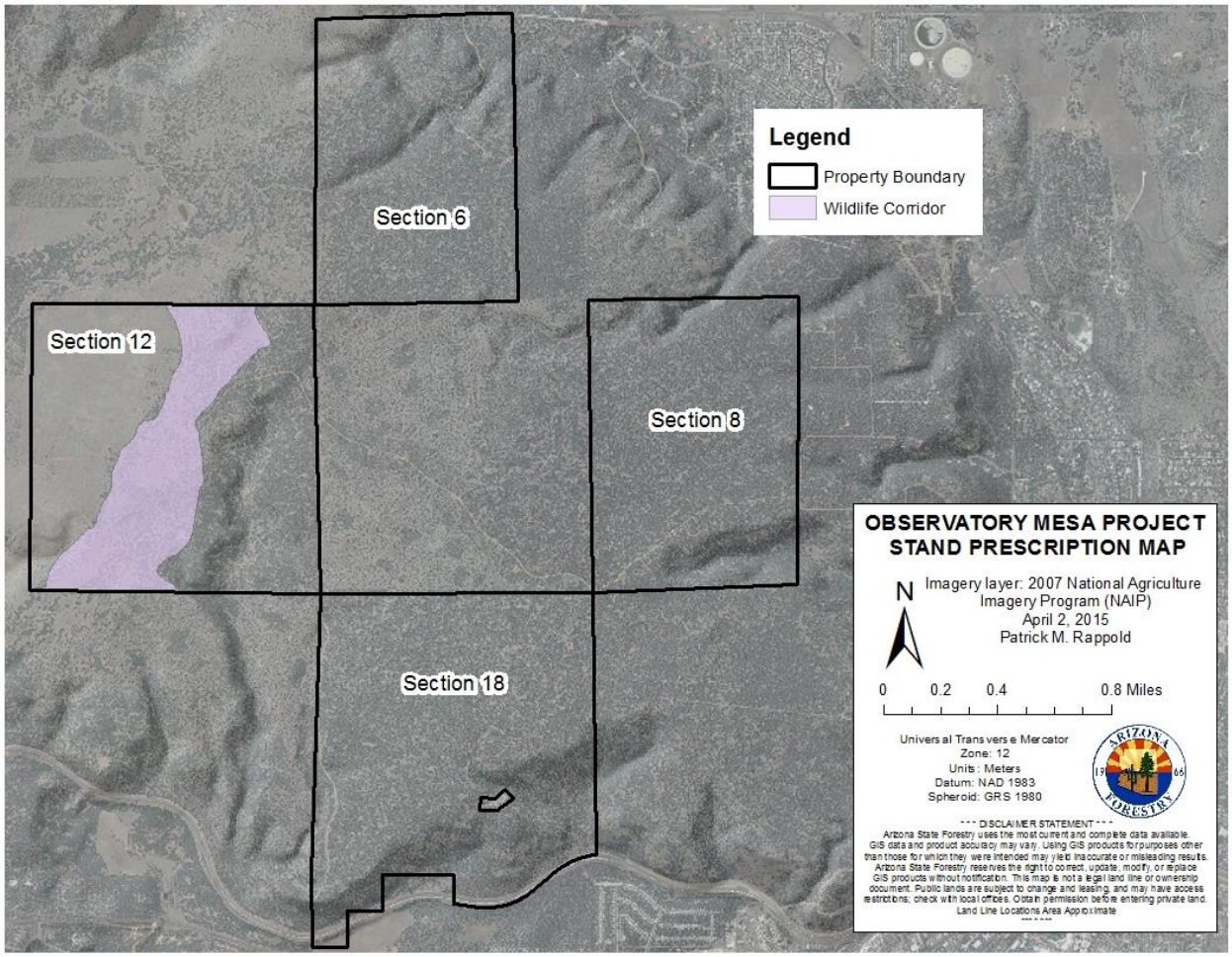


Map 13. Management prescriptions for the adjacent Four Forest Restoration Initiative project area; Alternative C. GIS Layer Source: US Forest Service Region III

A definitive timeline for the implementation of the proposed 4FRI treatments, adjacent to the Observatory Mesa project, is unknown at this time. It is recognized that City of Flagstaff treatments will be initiated before 4FRI treatments. Access and maintenance of forest haul roads during treatments of the Observatory Mesa areas will be of high priority to coordinate between the City of Flagstaff and US Forest Service staff. Prescribed (broadcast) fires on either of the jurisdictions could be coordinated to minimize site prep time, the risk of fire inadvertently crossing jurisdictional boundaries, and facilitate project goals.

Stand 1	Wildlife Corridor	Compartment 1	
Acres	193	Road Access?	Yes

Stand Map



Map 14. Wildlife corridor stand delineation area

Existing Conditions: This is a ponderosa pine stand. Basal Areas range from 40 to 180.

Desired Conditions: The central portion of the section: should be managed for savannah characteristics. Clumps should be thinned while retaining trees of all size classes. Clumps will vary in size from 1/10 acre up to 3 acres. Density will also vary from 40-110 basal area. These clumps should cover approximately 50 percent of the stand.

Treatment Objectives: Reduce habitat fragmentation and complement other larger and broader wildlife corridors, such as the San Francisco Peaks to Mogollon Rim Linkage. An in-depth detailed description of the San Francisco Peaks to Mogollon Rim Linkage and more

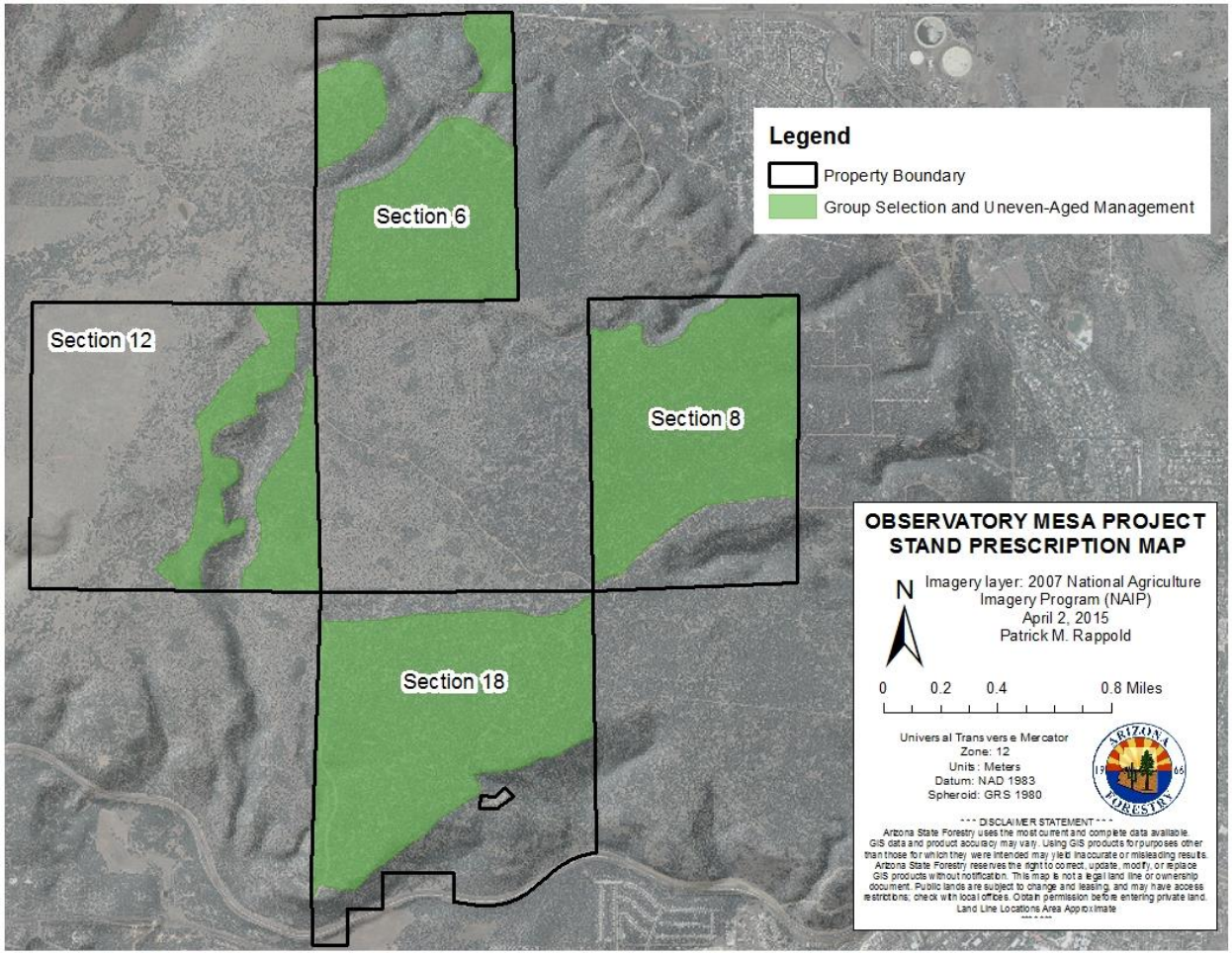
encompassing regional wildlife corridors is detailed in Arizona Game and Fish Department's 2013 Wildlife Connectivity Assessment report.[9]

Treatment Actions: Light to moderate hand thinning work focusing on improving stand structure. Create clumps with multi-aged stems, while reducing ladder fuels.

[9] Arizona Game and Fish Department. 2013. Coconino County Wildlife Connectivity Assessment: Detailed Linkages. San Francisco Peaks – Mogollon Rim Linkage Design. Phoenix, Arizona.

Stand 2	Group Selection & Uneven-Aged Management	Compartment 1	
Acres	1,222	Road Access?	Yes

Stand Map



Map 15. Group selection with intermediate thinning delineation area

Existing Conditions: This is a ponderosa pine stand. Basal Areas range from 40 to 180.

Desired Conditions: As a result of the treatment recommendations the stand structure would be multiage, multi-storied with a robust and diverse understory. This would be a lasting treatment that would remain effective from a fuels reduction standpoint for 20-30 years without another treatment.

Treatment Objectives:

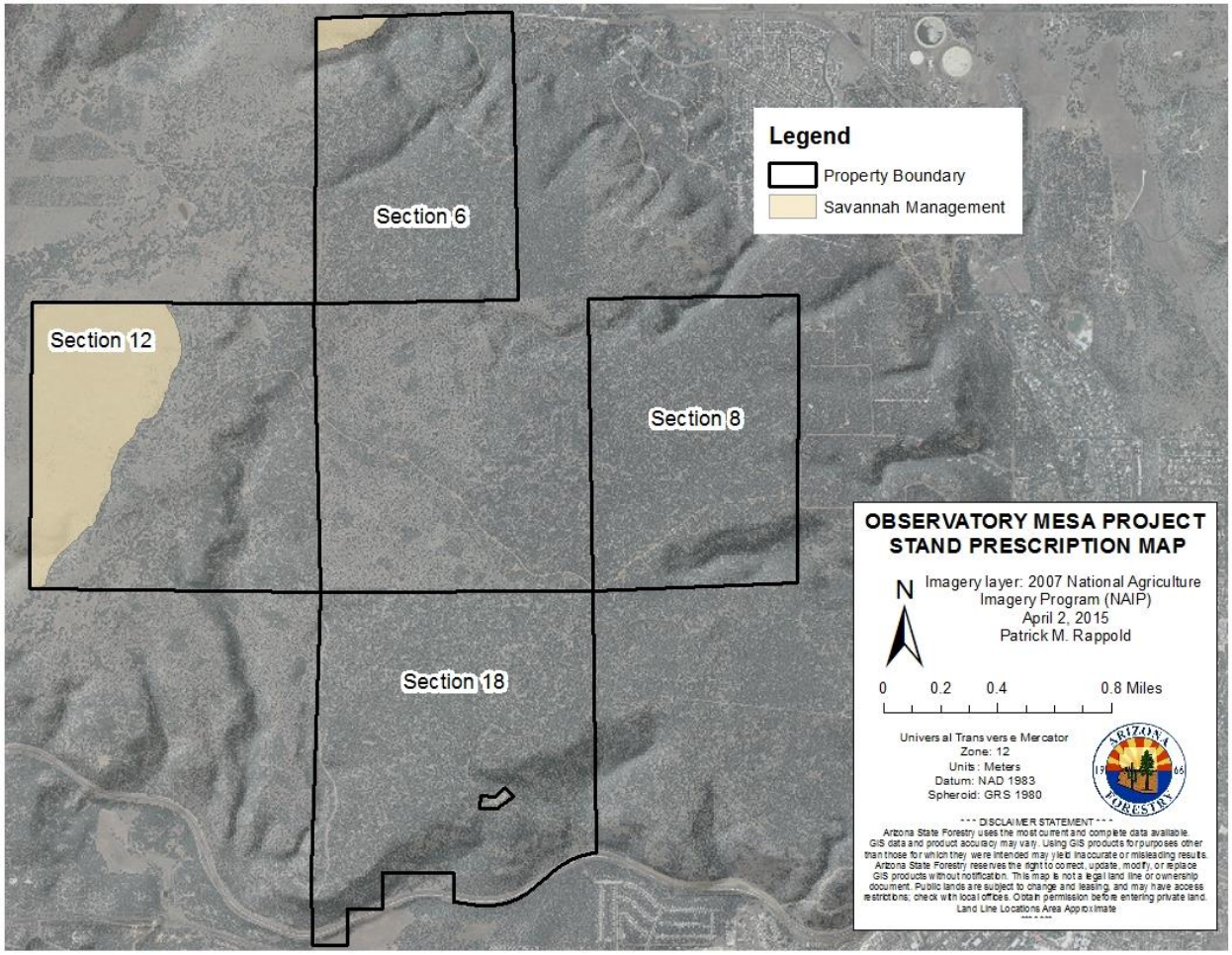
1. Create an uneven-aged groupy stand structure.

2. Improve residual tree growth, health, and vigor-with reduced density to desired stocking levels
3. Create 15% openings across the stand

Treatment Actions: Uneven-aged group selection. Leaving openings approx. 1-5 acres (site specific may allow larger), 10-20% deferral ½ to 2 acres in size. Groups should be well defined with interspaces. Concentrate groups on the rock outcrops and small hills. Swales should help define the interspaces. Interspaces should be approximately 5-10 tree heights (of the adjacent trees) wide. Overall basal area to average 50-80 BA, group basal area can exceed 150 if desired to accomplish multi-storied patches.

Stand 3	Savannah Management	Compartment 1	
Acres	231	Road Access?	Yes

Stand Map



Map 16. Meadow treatment delineation area

Existing Conditions: Stand 3 is the open savannah like landscape in Section 12 of the project area. This area was transformed into a grassland savannah landscape after the Belle Fire in 1951. Although this area has highly productive soils which are optimal for timber growth, this area is also a unique and is both ecologically significant and aesthetically pleasing. Vegetation within the area is composed of tall grass and would carry a fast spreading wildland fire very easily.

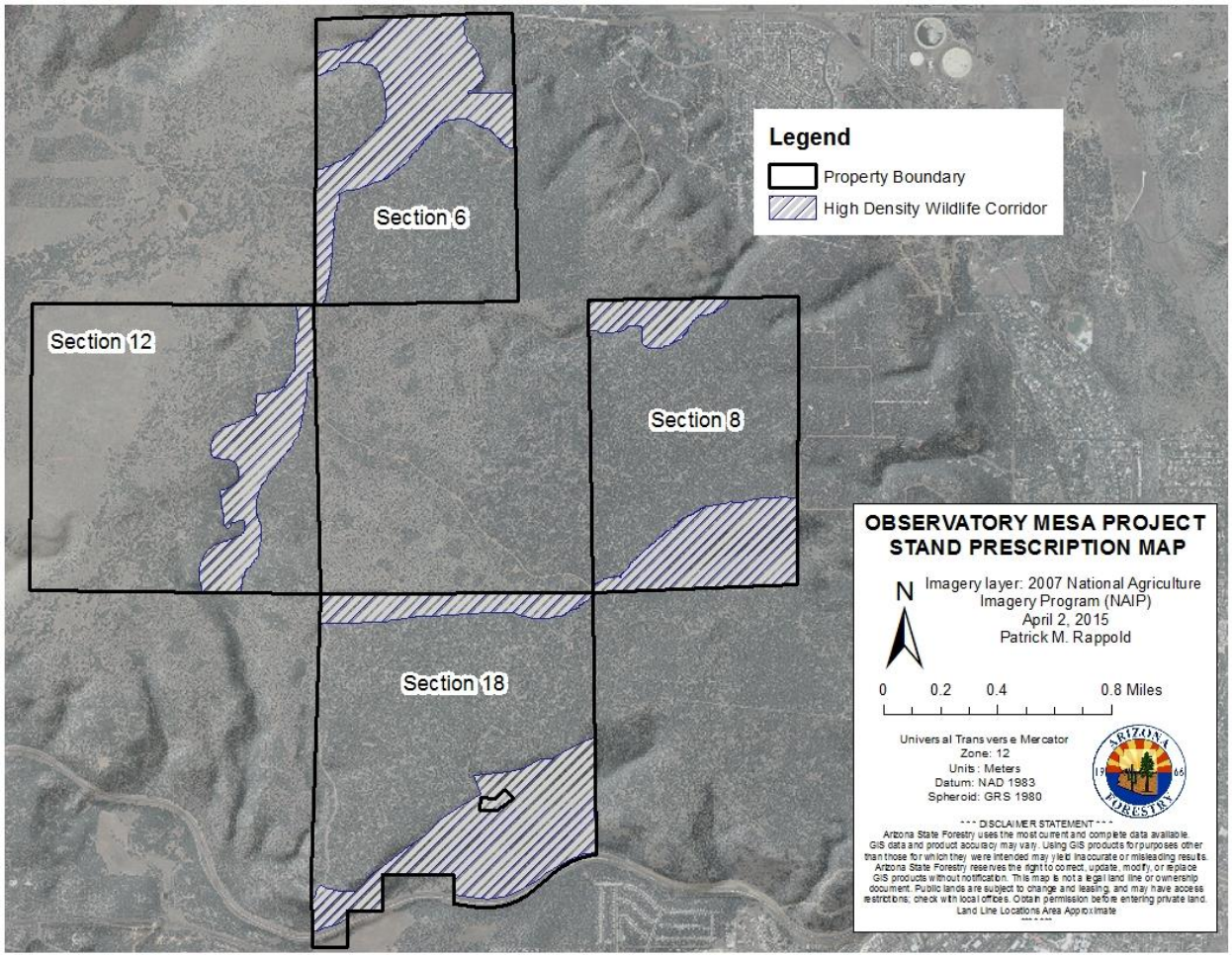
Desired Conditions: An open grass-dominated savannah

Treatment Objectives: Retain the unique characteristics of this area

Treatment Actions: Prescribed fire

Stand 4	High Density Wildlife Corridor	Compartment 1	
Acres	590	Road Access?	Yes

Stand Map



Map 17. High density wildlife corridor area

Existing Conditions: Portions of this stand have been identified as having slopes equal to or greater than 25 percent.

Desired Conditions: Maintain a high density wildlife corridor

Treatment Objectives:
Objective here is to maintain a high density wildlife corridor.

Treatment Actions:
Recommend shaded fuel break through aggressive understory thinning near the Hidden Hollow Community (southern portion of Section 18). Further up on the slope a lighter thinning should

occur. Oaks, where present, should be featured. This area should have a variable density hand thinning completed with residual basal areas between 70-120 BA.

Northwestern corner of Section 6: Maintain and enhance savannah structure. Hand thinning of current patches of trees to promote clumps/groups.

Eastern portion near West Ridge subdivision: Aggressive thinning from below to create a "shaded fuel break". Reduce BA to as residual 50-70.

Southern drainage to south section line: Maintain high density wildlife corridor. There was a light hand thinning conducted approximately 10 years ago. If a re-entry is desired, the drainage should receive a hand thinning. Basal area should range from 80-120 basal area. When conducting this thinning, care should be taken to maintain a presence of the smaller size classes throughout the stand